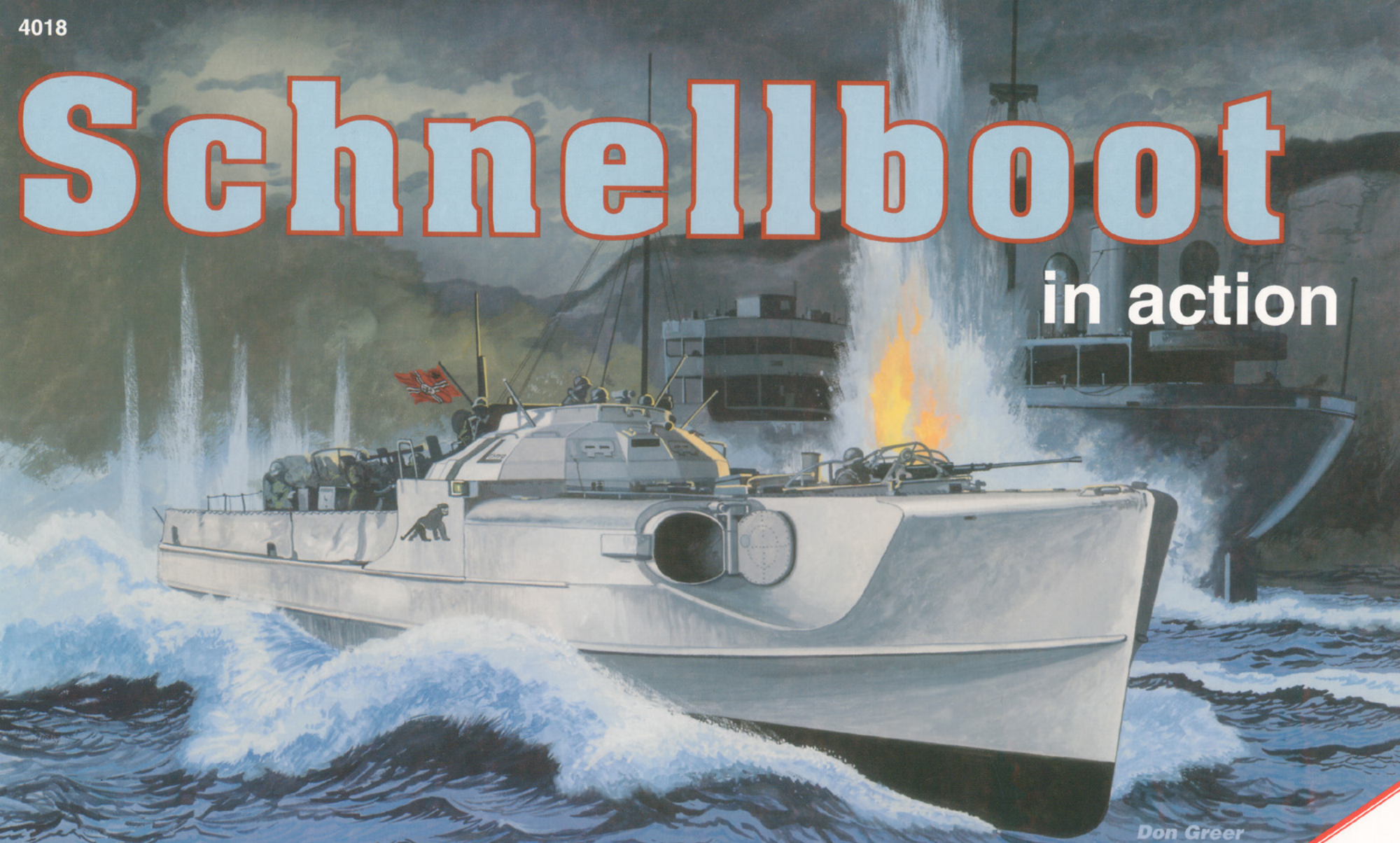
4018

# Schnellboot

## in action



Don Greer

Warships Number 18

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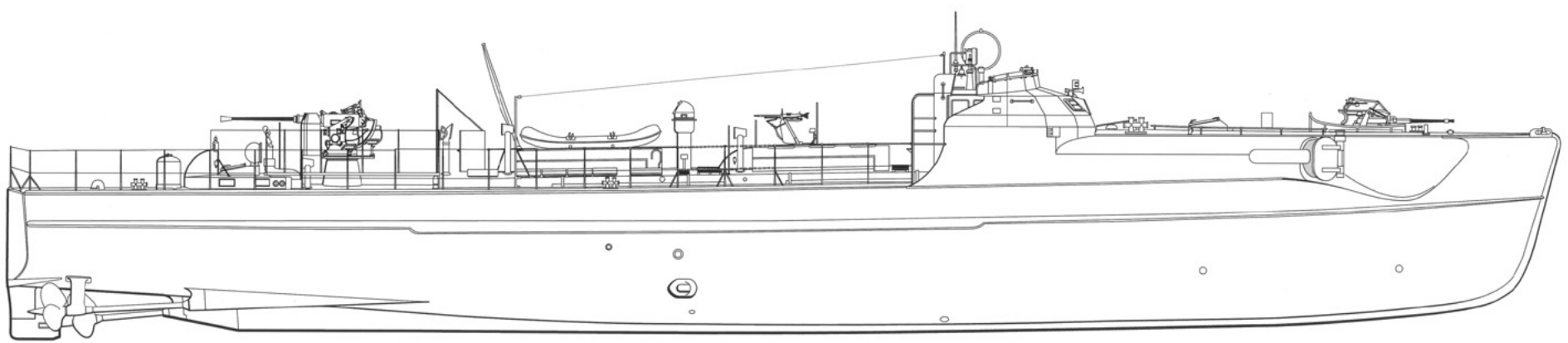
# Schnellboot
## in action


**By T. Garth Connelly and David L. Krakow**

**Color by Don Greer**

**Illustrated by Dave Gebhardt and Darren Glenn**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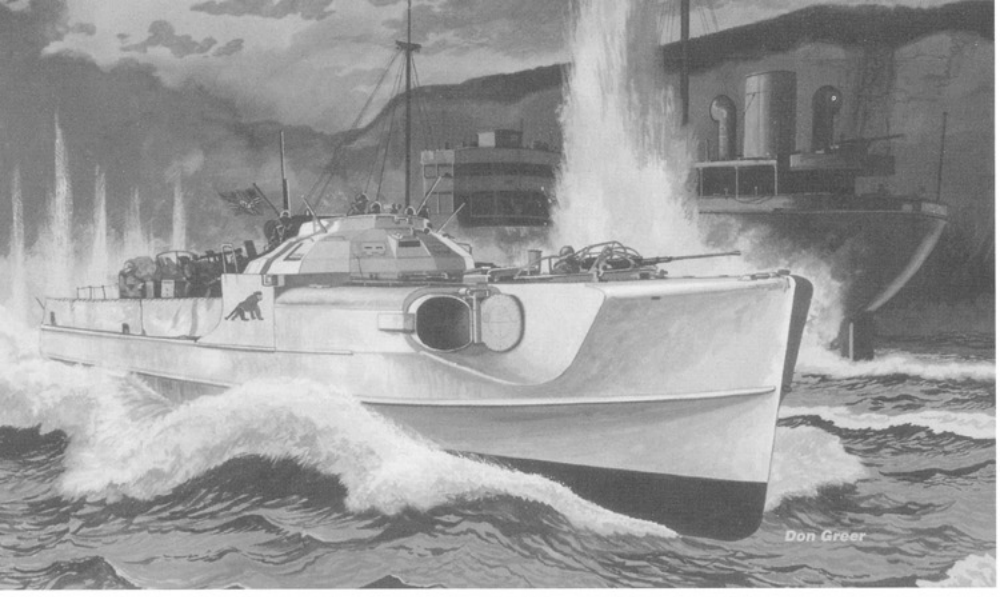


**An S-100 Class *Schnellboot* attacks British merchant shipping in the English Channel in late 1943. This was the lead boat in the last major *Schnellboote* class deployed during World War Two. The 4th *S-bootsflotille*'s panther insignia is painted on the midships bulkhead.**

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# Dedications:

Garth Connelly dedicates this book to:
My family
The memory of Donna Lynn Licsak, a best friend beyond compare. Of my friend, I can only say this: of all the souls I have encountered in my travels... hers was the most human.
To Nancy Gregoire and Kim Petitti, two of the best persons anyone can ever know.
To the memory of my hero, Dale Earnhardt, Sr. *"Go fast, turn left."*
To Martina Regnicolo: Cara mia. I did it again!

David Krakow dedicates this book to:
My Mom & Dad



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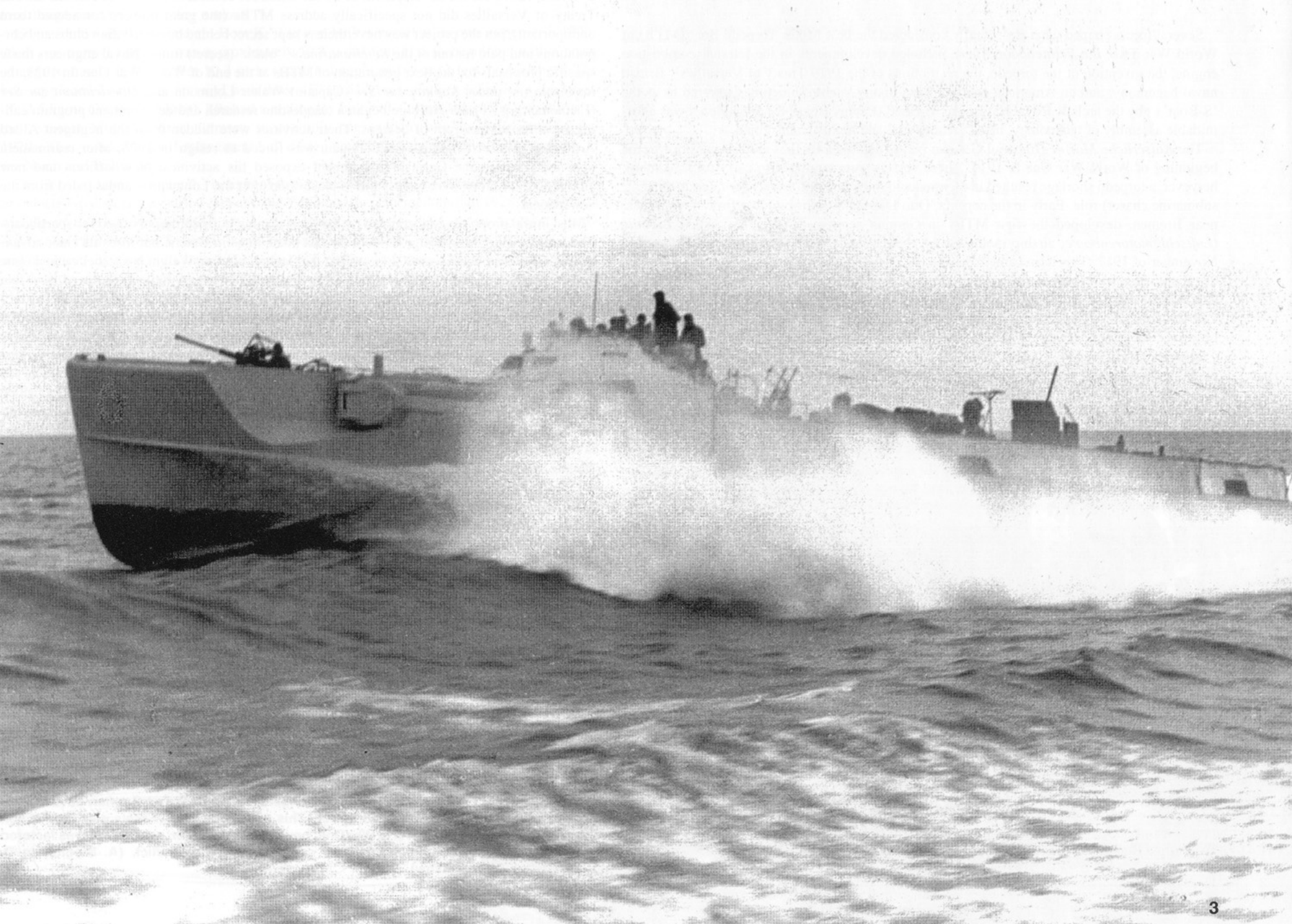
**Note on Caption Credits: PK stands for *Propaganda Kompanie* (Propaganda Company), to which the German photographer was assigned during World War Two.**

**An S-38b Class *S-boot* makes a fast run to base at daybreak. *Schnellboote* usually operated at night, where there was less of a threat from aircraft and surface ships. It carries the typical variety of armament used by these boats. This includes a 2 cm cannon, which is mounted in the foredeck, a 7.92mm MG34 *Zwillingslafette* (twin mount) fitted amidships, and a shielded 2 cm weapon located aft. The censor has removed this boat's flotilla number '6.' (PK Krönke via PT Boats, Inc.)**



# Introduction

Several forces shaped what is generally considered the best Motor Torpedo Boat (MTB) of World War Two, the ***Schnellboot***. These included developments in the internal combustion engine, the invention of the torpedo, the restrictions of the 1919 Treaty of Versailles[1], British naval hegemony, and an American contract for a luxury yacht. Sometimes referred to as the 'S-Boat' or by the archaic Royal Navy term 'E-Boat' (Enemy Boat), the *Schnellboot* was a formidable assembly of technology, naval architecture, and highly trained men.

The *Kaiserliche Marine* (Imperial German Navy) deployed its first motorboats prior to the beginning of World War One in 1914. These vessels were equipped to carry torpedo tubes; however, a torpedo shortage resulted in their redeployment in the ***Unterseeboot Zerstörer*** (UZ; submarine chaser) role. Early in the conflict, Otto Lürssen's yacht-building firm in Vegesack, near Bremen, developed the first MTBs in German service. Initially designated ***L-boote*** (*Luftschiffmotorenboote*; airship motor boats), these vessels were redesignated ***LM-boote*** in November of 1917. This term came from the use of 240 horsepower (HP) Maybach six cylinder airship engines, which were light, powerful, and readily available to power these craft. The first four boats (**LM-1** through **LM-4**) were armed with one 3.7 CM gun, but **LM-5** through **LM-20** had a single bow-mounted torpedo tube and several machine guns. The Germans had little success with these craft, which saw action in the Baltic and North seas.

Almost immediately after World War One ended in 1918, German military strategists began planning for the next conflict. Although the Treaty of Versailles was meant to prevent Germany from mounting a war of aggression, its practical effect was to stimulate an ingenious and advanced arms development program. German engineers designed weapons which both circumvented this treaty's restrictions and capitalized on technologies and tactics that could enable a small, well-equipped nation to rapidly defeat a more powerful but outdated enemy.

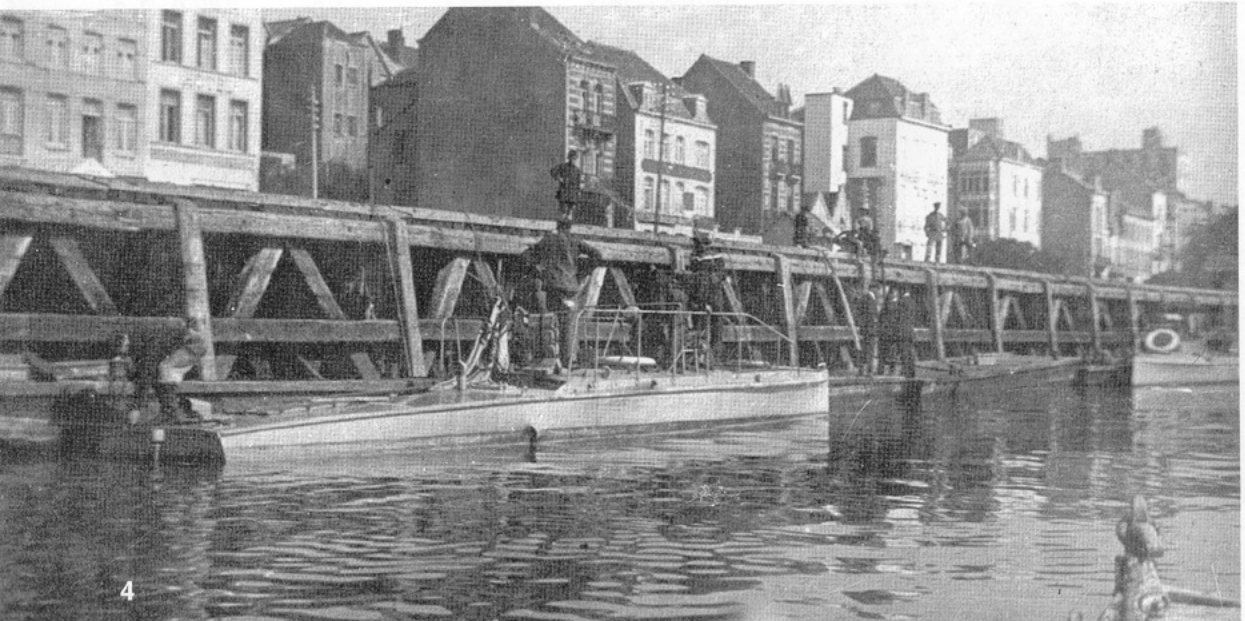
The German naval command, considering the severe limitations of the peace treaty and capitalizing on its limited experience with light Motor Gun Boats (MGB) and MTBs at Zeebrugge, Belgium, called for the development of a boat suited for combat in North Sea conditions. The Treaty of Versailles did not specifically address MTBs (the great powers considered them unimportant), but the project was nevertheless kept secret behind bogus civilian clubs and corporations and paid for out of the *Reichsmarine*'s[2] 'black' (secret) funds. Naval engineers made specific proposals for the next generation of MTBs at the end of World War One. In 1923, the *Reichsmarine* under *Kapitan zur See* (Captain) Walter Lohmann and *Oberleutnant zur See* (Lieutenant j.g.) Friedrich Ruge began a clandestine research and development program calling for a broad spectrum of designs. Their activities were hidden from the negligent Allied Armistice Control Commission. Lohmann was forced to resign in 1928, after rearmament opponents within the German government exposed his activities. New officers and new dummy corporations were quietly put in place soon after the Lohmann scandal faded from the newspapers.

Most initial proposals concentrated on the short planing hulls commonly used for speedboats. This surface skimming design is ideal for fast boats in calm waters, but loses its chief advantage of efficiency when waves slam against the flat hull bottom. Weight is another critical issue and the iridescent plume of water created by a planing boat moving at high speed is visible over great distances at night. The latter was clearly undesirable for a stealthy military vessel.

In 1926, Abeking & Rasmussen designed and built one such craft, **'Experimental Boat K,'** along the lines of the Royal Navy's 55 foot (16.8 M) Thornycroft Coastal Motor Boat. It was approximately 18.3 M (60 feet) long and displaced 16 tons (14.5 MT). Two 450 HP gasoline engines powered two shafts, giving the boat a maximum speed of approximately 40 knots (46 MPH/74 KMH). The main armament was a pair of aft-firing 45.7 CM (18 inch) torpedoes, which followed the British design. A proposal for forward-firing torpedoes envisioned a pair of roll-off side launching rails based on the Italian method. The double-planked mahogany construction was typical for torpedo boats of that period, but it was insubstantial to prevent damage and leaking, even at 25 knots (29 MPH/46 KMH) in calm seas. Attempts to strengthen the hull were

[1]The Treaty of Versailles formally ending World War One between Germany and the Allied Powers (primarily Great Britain, France, the United States, and Italy) was signed on 28 June 1919.

[2]The *Kaiserliche Marine* was renamed the *Reichsmarine* on 1 January 1921. The service's name was changed to the *Kriegsmarine* on 21 May 1935.



# Terminology

The German term *Schnellboot* (literally 'speedboat') and its German abbreviation *S-boot* are used throughout, along with the plural *Schnellboote* and *S-boote*, in preference to the hybrid German/English terms 'S-boat' and S-boats'. Similarly, German submarines are referred to as *U-boote* (*Unterseeboote*; 'undersea boats'). Where the metric system was used by the designers and builders, all specifications and dimensions are given in that form (e.g. for German boats and equipment), while for those built by countries using the imperial system (e.g. the United Kingdom and the USA), imperial measures are used. The exceptions are for speeds which are, by convention, given as knots (one nautical mile per hour, equivalent to 1.853 KMH) and displacements, given as tons standard displacement in all cases.

**A *Kaiserliche Marine* (Imperial German Navy) Motor Gun Boat (MGB) is moored at Zeebrugge, Belgium in 1917. The vessel is armed with a bow-mounted 7.92MM MG08/15 machine gun. Zeebrugge – located in the Belgian region of Flanders – was a base of German naval operations in the North Sea. This and other light vessels saw little action during World War One; however, their limited experience was factored into the *Schnellboot* concept after the conflict. (A. Stegitz via D. Krakow)**

unsuccessful. *Reichsmarine* testing of 'Experimental Boat K' and several other designs further underscored the superiority of the round-bilged displacement hull over the hard chine V-bottom design used by most other nations.

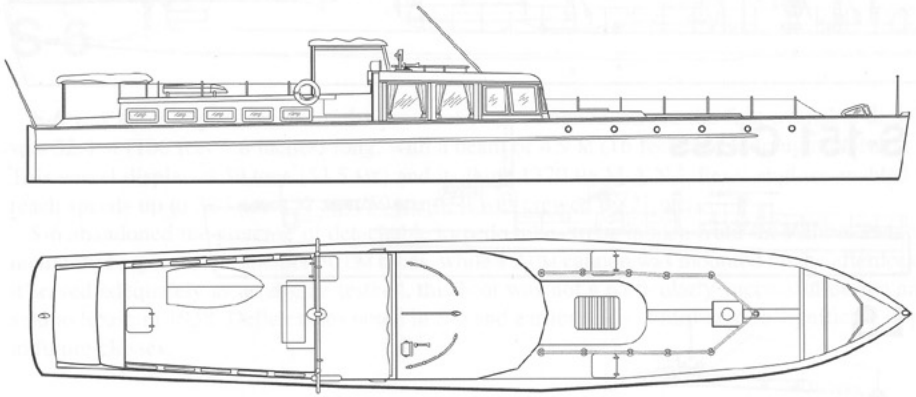
Concurrent with 'Experimental Boat K,' Lürssen built a vessel at its own expense in 1925-26. It was named **Lür** and was approximately 19.8 M (64 feet 11.5 inches) long, with a beam of approximately 2.7 M (8 feet 10.3 inches) and a draught of 0.9 M (2 feet 11.4 inches). The boat displaced 23 tons (21 MT) and with three 450 HP Maybach engines achieved a top speed of 33.5 knots (39 MPH/62 KMH). Lür had a mahogany hull and a round bilged design similar to the 'Express Motor Cruiser' Lürssen successfully marketed to wealthy Americans in the 1920s. The rounded bilge displacement hull design proved to be well suited for operations in the North and Baltic seas.

The German naval command – in light of these experiments and the dismal North Sea weather - elected to concentrate strictly on a round-bottomed displacement hull in 1928. Its attention was drawn to a highly innovative motor yacht Lürssen built for the German-American banking tycoon Otto Herman Kahn. Its round-bottomed hull was 22.5 M (73 feet 9.8 inches) long and displaced 22.5 tons (20.4 MT). The vessel was powered by three 550 HP Maybach engines and reached a top speed of 34 knots (39 MPH/63 KMH), making it the world's fastest boat in its class at the time. It was named **Oheka II** after Kahn's initials. In it, Lürssen overcame many of the drawbacks of the round-bottomed displacement hull. The boat utilized a composite construction of wood planks over alloy frames for reduced weight. An underwater hull form flattened towards the stern provided hydrodynamic lift where it was needed. This counterbalanced the inefficient tendency for round hulls to 'squat' stern-down at high speeds.

Oheka II's combination of speed, strength, and seaworthiness was precisely what the German naval command wanted. Additionally, the large displacement would minimize the balance effects of carrying and firing two heavy torpedoes far forward of the hull's center of gravity. The *Reichsmarine* awarded Lürssen a contract to build a boat to the same basic design in November of 1929. This vessel would differ from Oheka II in having two detachable torpedo tubes on the forecastle, a slightly improved top speed, and other minor differences. It was commissioned into the *Reichsmarine* as the **UZ (S).16**[3] in 1930, but was renamed **S-1** in 1932. It was Germany's first true MTB and was the basis for all other *S-boote* built before and during World War Two.

[3]UZ(S); *Unterseeboot Zerstörer (Schnell)*; Fast Submarine Destroyer, or Chaser.

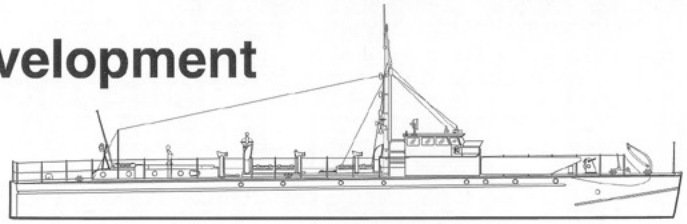
## Oheka II



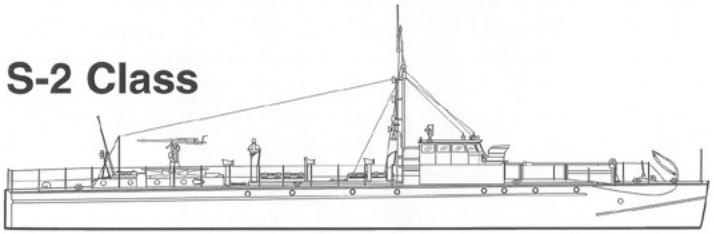
**The aggressive spirit of the *Schnellboot* fleet is typified in this prewar view of S-19. This S-18 Class vessel has black hull numbers, which were overpainted for security reasons after World War Two began. Experiments dating back to the mid-1920s led to the *Schnellboot* – a highly capable motor torpedo boat optimized for both North Sea and Baltic Sea conditions. (D. Krakow)**

# Development

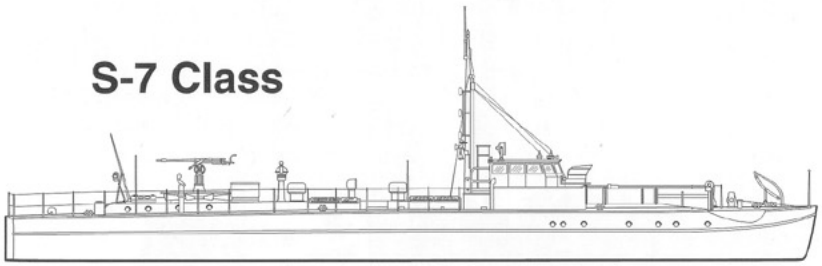
## S-1



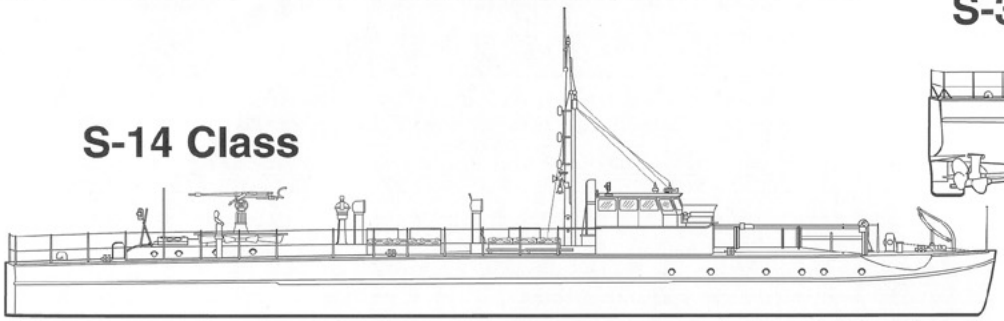
## S-2 Class



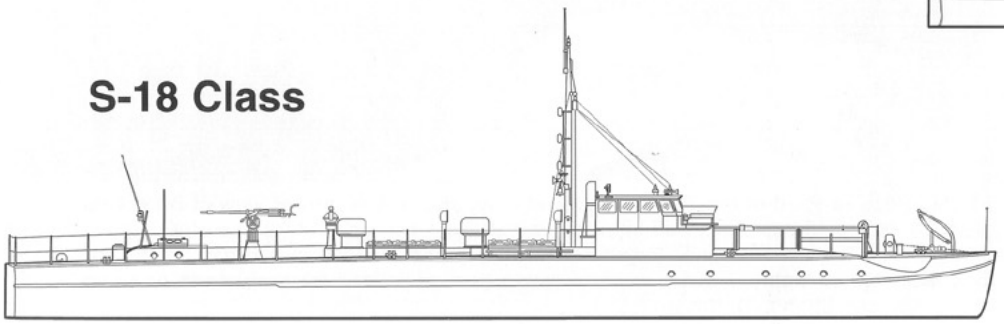
## S-7 Class



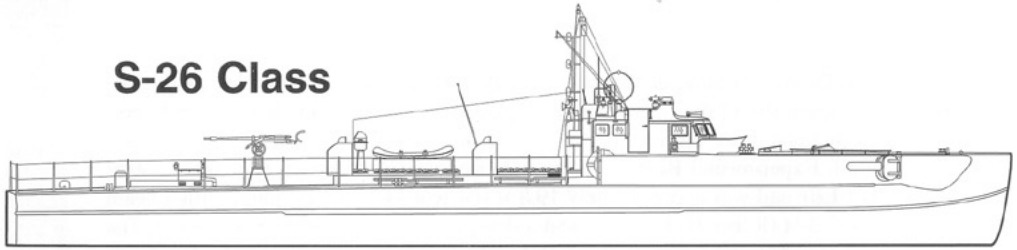
## S-14 Class



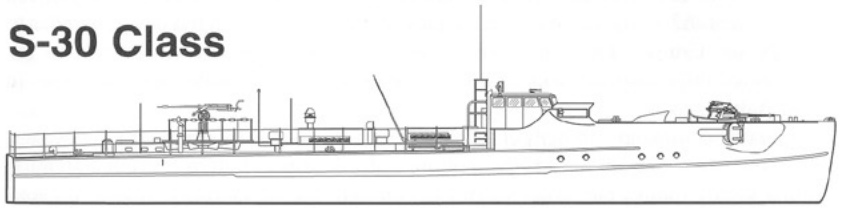
## S-18 Class



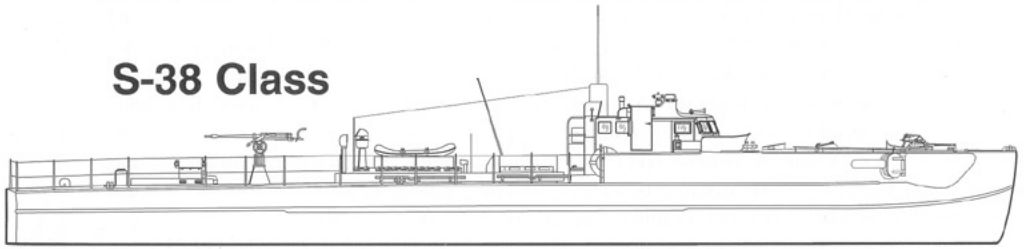
## S-26 Class



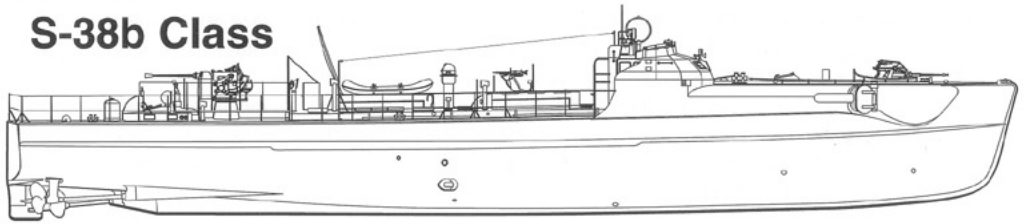
## S-30 Class



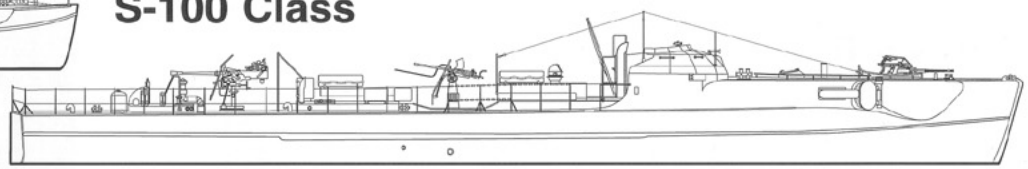
## S-38 Class



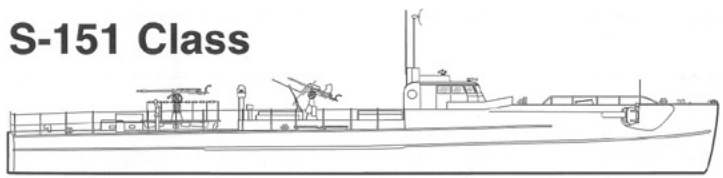
## S-38b Class



## S-100 Class



## S-151 Class



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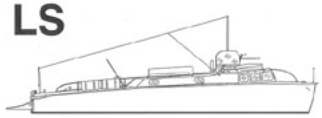


# S-1

The *Reichsmarine* commissioned S-1 on 7 August 1930 and referred to this craft by the simple cover name *'Schnellboot,'* which eventually became this type of vessel's official classification. It had a mahogany and light metal composite construction. S-1 was also a round-bilged design capable of high speed, even in heavy seas. Three 800 to 900 HP Daimler-Benz BFZ V-12 cylinder four-stroke gasoline engines provided power. S-1 was 26.5 M (87 feet) long, with a beam of 4.2 M (13 feet 9.4 inches) and a draught of 1.1 M (3 feet 7 inches). The boat was armed with two 50 CM (19.7 inch) torpedo tubes – which could be removed to hide them from Allied intelligence – and one 2 CM cannon on the afterdeck, and had a crew of 12 men. At 39.8 tons (36 MT), it was the largest high-speed coastal motor boat of its day.

S-1 proved to be an excellent and versatile design with superior range of 582 nautical miles (670 miles/1079 KM) at 22 knots (25 MPH/41 KMH). It had seakeeping ability at up to Beaufort Sea State 5 (wind speed 17 knots [20 MPH/32 KMH] to 21 knots [24 MPH/39 KMH] and waves up to six feet/1.8 M high). Experiments with S-1 and the later **S-2** Class led to immediate improvements and innovations. Germany sold S-1 to Spain in 1938.

# S-2 Class (S-2 through S-5)

Lürssen delivered **S-2** to **S-5** to the *Reichsmarine* between April and July of 1932. These four boats were similar to S-1 in general appearance, but the length was increased to 27.9 M (91 feet 6 inches). The S-2 Class had a heavier displacement of 49 tons (44.5 MT) to facilitate an improved layout and additional equipment. This included a quiet 100 HP Maybach auxiliary engine linked to the center propeller shaft via a chain. It was intended for silent running, but was found unnecessary and phased out.

Another improvement was the addition of superchargers to the three BFz V-12 engines, which increased output to 1100 HP. A key innovation beginning with S-2 was the addition of a special rudder arrangement. Two smaller rudders flanking the main rudder could be angled outboard up to 30°. At high speed, the angled rudders drew a ventilation air pocket slightly behind the three propellers. This increased their efficiency, reduced stern wake, and kept the boat's pitch close to horizontal – a phenomenon that became known as the *'Lürssen Effekt.'*

S-2 to S-5 formed the nucleus of the First *Schnellboot* Sub-Flotilla and was immediately put to use for intensively training crewmen and developing tactics. Both armament and crew compliment remained the same as the earlier S-1. S-2 to S-5 were sold to Spain in 1938, when more modern *Schnellboote* became available.

# S-6

**S-6** was an enlarged version of the previous class designed around the first available diesel engine. It was 32.4 M (106 feet 3.6 inches) long, with a beam of 4.9 M (16 feet) and a draught of 1.2 M (four feet). This vessel displaced 59 tons (53.5 MT) and its three 1320 HP M.A.N.[1] diesel engines enabled the craft to reach speeds up to 32 knots (37 MPH/59 KMH). It was crewed by 21 men.

S-6 abandoned the pretense of detachable torpedo tubes to be hidden from the Allies. Two 53.3 CM (21 inch) tubes replaced the smaller 50 CM tubes, while a 2 CM cannon was mounted on the afterdeck. Although it served adequately as an engine testbed, this boat was not a particularly successful design and was also sold to Spain in 1938. Deficiencies noted in S-6 and earlier boats contributed to significant improvements in future classes.

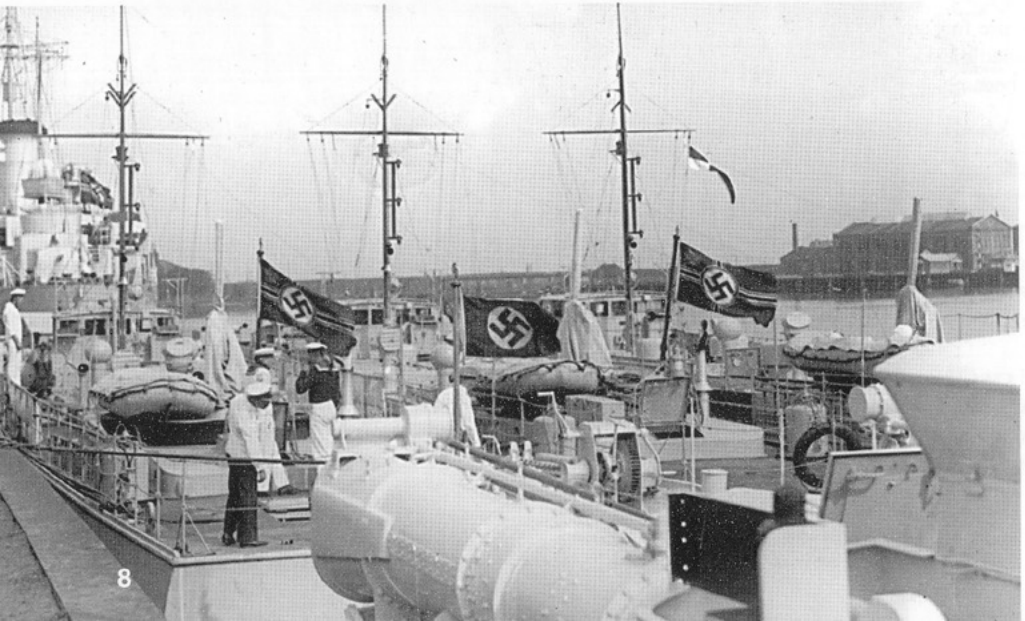
[1]M.A.N.: *Maschinenfabrik Augsburg-Nürnberg* (Augsburg-Nuremberg Engineering Works)

**S-1 navigates the Kiel Canal connecting the North and Baltic Seas in the early 1930s. Affectionately known as *'Mäxchen'* (Little Max), this vessel was the prototype for all other World War Two classes of *Schnellboote*. Canvas sheets cover both its open-front torpedo tubes. S-1's vertical surfaces are painted *Hellgrau* (Light Gray) 4 (approximately FS16515). (Lürssen)**

**The S-2 Class boat S-4 displayed several improvements over the S-1, including the addition of front shutters to the torpedo tubes. S-4 flies the 1933 pattern *Reichsmarine* naval ensign – a black, white, and red tricolor with a black Iron Cross – which was replaced on 9 November 1935. (A. Klein via D. Krakow)**

**The S-7 Class vessels (from left) S-9, S-10, and S-11 display their improved bow design while berthed prior to World War Two. Semaphore signal arms high on the masts were used for daylight signaling; red and white lamps below were used at night. White hull numbers were painted on the bows. (Lürssen)**

**This same group of *Schnellboote* lies at anchor immediately aft of their flotilla depot ship TSINGTAU. The *Reichkriegsflagge* (German naval ensign) ensign adopted on 9 November 1935 flies from their stern flagstaffs, while the *Gösch* (German naval jack) is displayed on the jackstaff of another *S-boot*. (Lürssen)**



# S-7 Class (S-7 through S-13)

A knuckle was added at the bow beginning with **S-7** in 1934. This feature increased reserve buoyancy at the bow and prevented the boat from nosing into waves in four weather. S-7 to **S-13** entered service from October of 1934 to December of 1935. These 75 ton (68 MT) boats, built with the same dimensions as S-6, were heavier because of different engine installations. A 7.92MM machine gun was mounted in the bow for use against surface and aerial targets. The *Kriegsmarine* determined early in the series that the S-7 Class were not yet fast enough for its requirements. Consequently, later boats up to **S-17** served as testbeds for new motor types and configurations. Additionally, Lürssen built three boats of this type for export to China, five for Bulgaria, and eight for Yugoslavia.

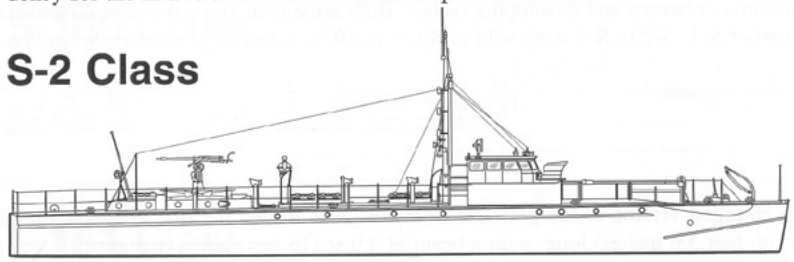
# S-14 Class (S-14 through S-17)

The four **S-14** Class boats built from 1936 until 1938 were based on the previous S-7 Class, but built larger to accommodate an 11-cylinder M.A.N. L11/Zu diesel engine. The craft had a length of 34.6 M (113 feet 6.2 inches), a beam of 5.1 M (16 feet 9 inches), and a draught of 1.5 M (4 feet 11 inches). The four boats each displaced 97 tons (88 MT) and were crewed by 21 men. Armament consisted of two 53.3 CM torpedo tubes and one 2 CM cannon.

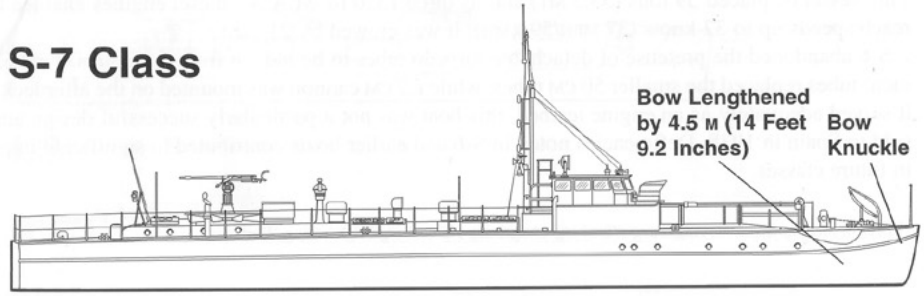
# S-18 Class (S-18 through S-25)

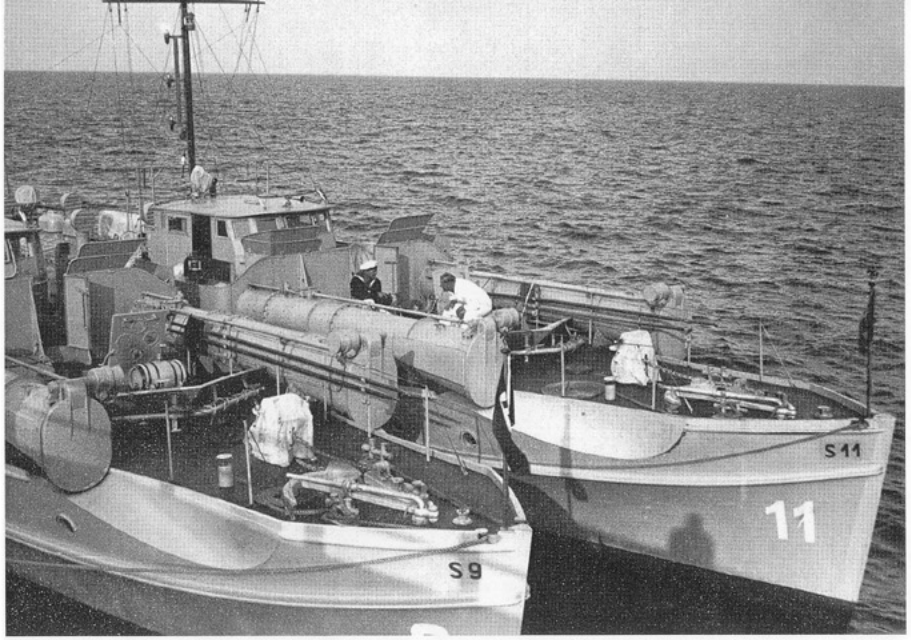
The eight-boat **S-18** Class of 1938-39 was based on the earlier S-7 Class, but powered by three advanced 2050 HP Daimler-Benz MB 501 diesel engines. The powerplant enabled this vessel to reach a maximum speed of 39.5 knots (46 MPH/73 KMH). This class added a wedge to the lower stern, which deflected the water flow slightly downwards and counteracted any tendency for the hull to settle into the water as speed increased.

## S-2 Class



## S-7 Class



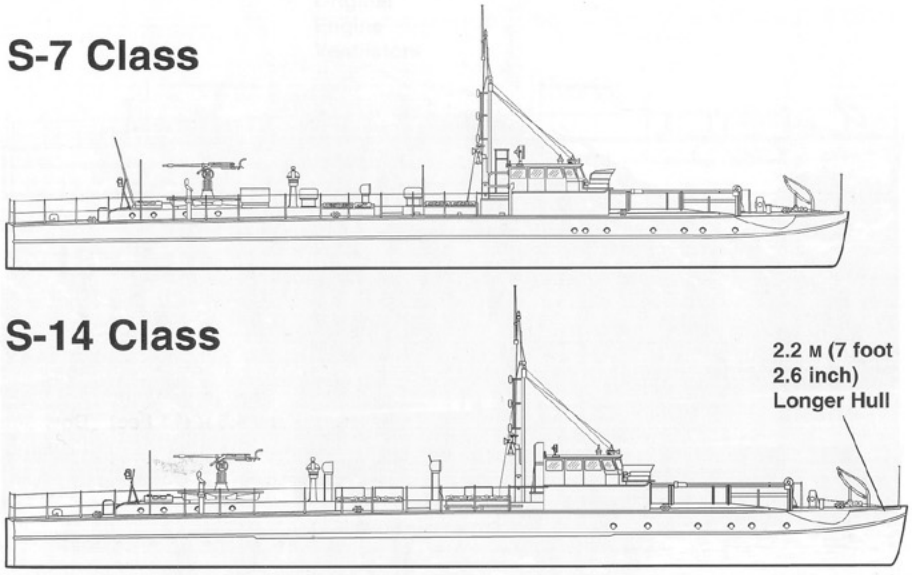



**S-9 and S-11 lie beside each other while painted in the prewar light gray scheme. The *S-boot*'s wooden planked decks were finished with a layer of canvas permeated with special waterproof and wear-resistant dark gray (approx. FS26187) paint. S9 and S11 are black on the upper bows of their respective vessels. (D. Krakow)**

The S-18 Class's external dimensions were the same as for the S-14 Class, as was its displacement of 92 tons. Individual boats in this class differed in ventilator layout, like on earlier *Schnellboot* classes. The long, low trunk type first utilized on S-18 proved most satisfactory and was adopted by the later **S-26 Class** boats.

**S-11 cuts through its leader's wake during pre-war exercises. Upward hinging shutters closed off the 53.3 cm (21 inch) torpedo tubes. The *Schnellboot* crew's pride and confidence remained unabated through the bitterest days of World War Two. (W. Andres via D. Krakow)**

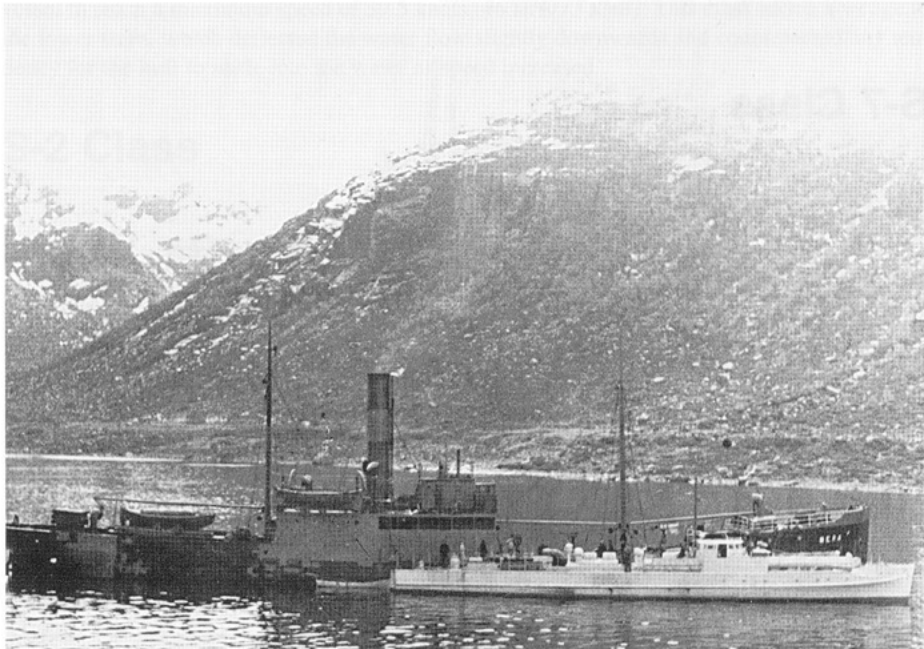
**In 1937-38, black hull numbers replaced white numbers on S-16 and other *Schnellboote*. These vessels were also repainted in the new near-white *Schnellbootweiss* (approx. FS27875) scheme, which was found optimal for night operations. The 2 cm Rheinmetall C/30 cannon mounted on the aft deck was primarily an anti-aircraft weapon. (Lürssen)**



The S-14 Class boat S-15 cruises off the German coast prior to World War Two. Canvas dodgers hung from the craft's railing to keep seawater off the after deck. A cast bronze *Reichsadler* (Reich Eagle and Swastika) is mounted on the bridge side. This emblem was removed from *Schnellboote* when the conflict began. (A. Klein via D. Krakow)

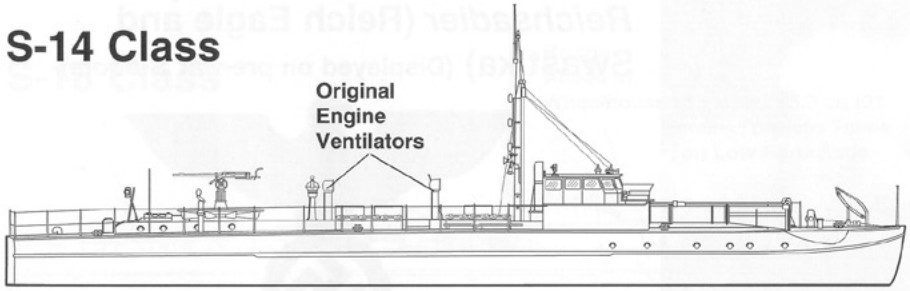
An S-14 Class vessel makes a high speed run off the Norwegian coast during the war. Hull numbers were painted over for security when the Second World War started. Although outdated by rapid design developments, the early *S-boote* performed important patrol and escort duties during the conflict. (PK Krönke via PT Boats, Inc.)

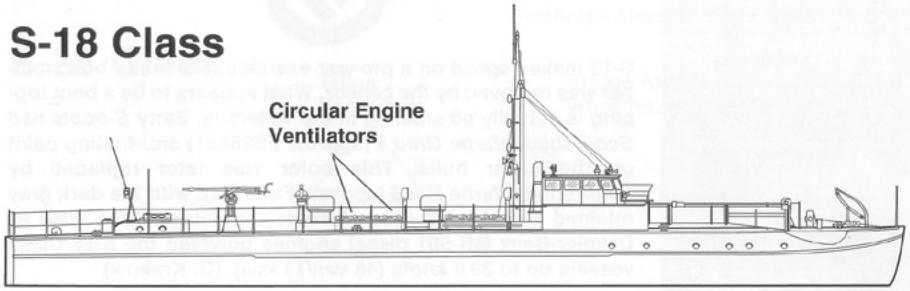
This S-14 Class *Schnellboot* has pulled alongside a merchant ship in Norwegian waters. The German boat's crew stopped the freighter to search for contraband. The merchant ship's crew was helpless against the *S-boot*'s weapons. *S-boote* commonly patrolled the coastal waters of German-occupied Europe. (PK Krönke via PT Boats, Inc.)

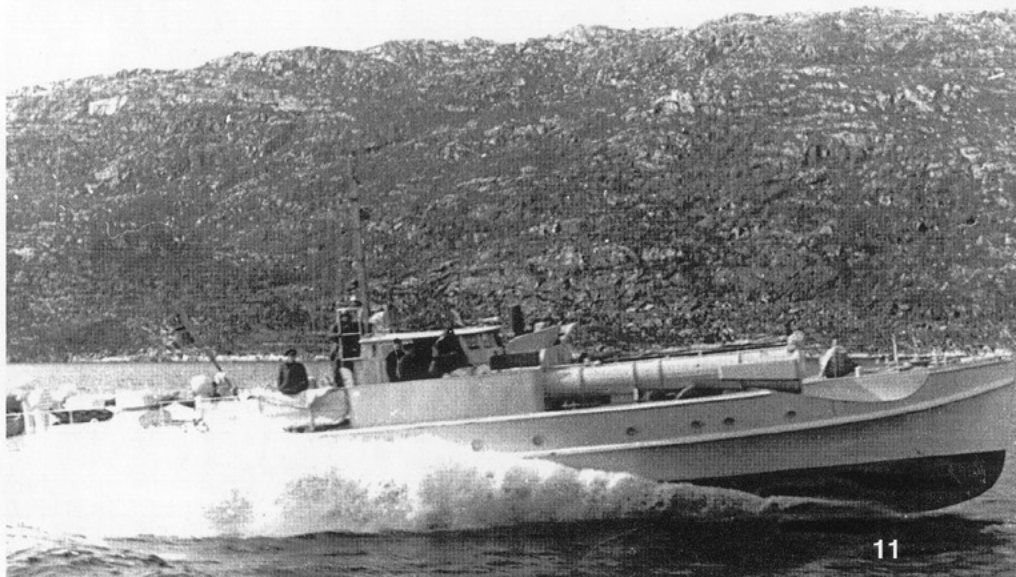


The S-14 Class *S-boot* makes a wide circle after inspecting a merchant ship off Norway. These vessels turned primarily using the rudder, although differential engine power was also employed on occasion. While coastal patrols were undertaken at all hours, *Schnellboot* crews preferred nighttime attacks to minimize the threat from enemy aircraft and surface ships. (PK Krönke via PT Boats, Inc.)

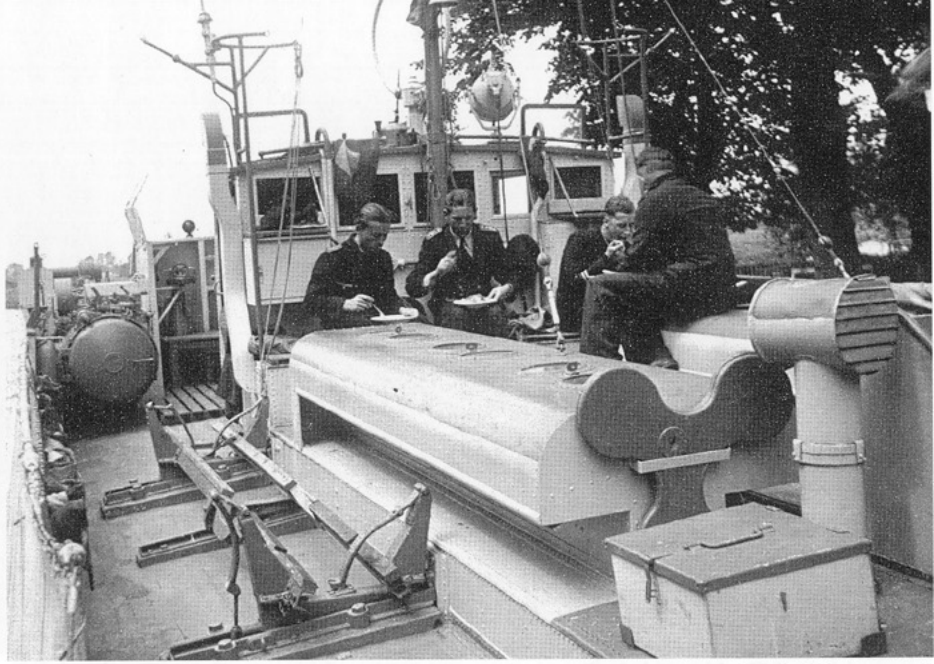
An S-14 Class boat cruises past the rocky Norwegian coastline during a patrol mission in World War Two. The portholes along the upper hull sides were eliminated on later *S-boote* to both simplify production and to provide additional strength in the hull. Both torpedo tubes are exposed on the foredeck. (PK Krönke via PT Boats, Inc.)



The S-18 Class S-19 crests the wake of the leader in a pre-war exercise. Two wing rudders and a stern wedge ordinarily counteracted the tendency for these boats to nose up at speed. Wing rudders worked with the larger main rudder for lateral control of the vessel. This class introduced the stern wedge that became standard on later *Schnellboote*. The cast bronze *Reichsadler* (Reich Eagle and Swastika) was removed from the superstructure of *Kriegsmarine* warships when World War Two began. (F. Urbans via David Krakow)



Officers of S-18 pause for lunch aboard their craft. They are seated on the deckhouse and ventilator above the forward engine room. The early sliding racks enabled torpedoes to be stowed neatly inboard against the deckhouses. These were phased out with the S-26 Class. The experimental low ventilation trunks over the engine room were standardized on later boats. The clover leaf object is a skylight blackout cover for a gangway hatch. (D. Krakow)

## *Reichsadler* (Reich Eagle and Swastika) (Displayed on pre-war *S-boote*)

S-19 makes speed on a pre-war exercise. The white bow number was removed by the censor. What appears to be a boot topping is actually oil staining at the waterline. Early *S-boote* had *Schiffsbodenfarbe Grau 1* (approx. FS36081) anti-fouling paint on the lower hulls. This color was later replaced by *Schiffsbodenfarbe Rot 5* (approx. FS20152), with the dark gray retained as a boot topping to hide oil stains. Three 2050 HP Daimler-Benz MB 501 diesel engines powered the S-18 Class vessels up to 39.5 knots (46 MPH/73 KMH). (D. Krakow)

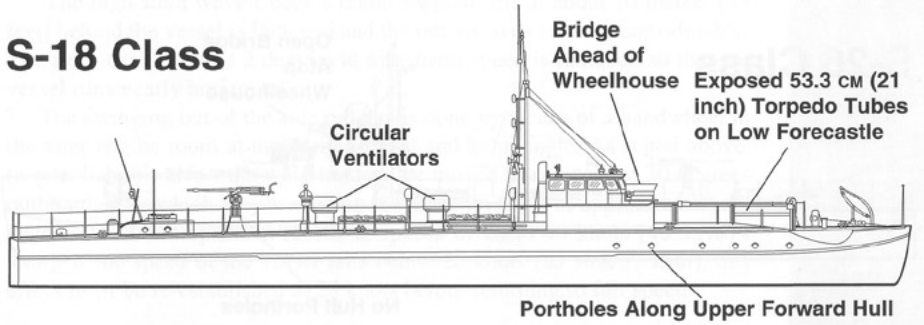
# S-26 Class (S-26 through S-29)

The four S-26 Class boats built between 1939 and 1940 were a continuation of the previous S-18 Class, but with significant changes to the superstructure. The two 53.3 CM (21 inch) torpedo tubes were enclosed in a decked-over forecastle, increasing both interior space and reserve buoyancy. The extra 0.5 M (1 foot 7.7 inches) of freeboard also kept the boats drier. The S-26 Class boat measured 35 M (114 feet 10 inches) in length, 5.1 M (16 feet 9 inches) in beam, and 1.5 M (5 feet) in draught. It had a displacement of 92 tons (84 MT).

A cockpit was set into the wheelhouse roof, placing the commander in a centralized position with improved visibility and shelter over previous designs, in which he was forced to stand forward of the wheelhouse. From there, he could speak through portholes directly to the wheelhouse forward and the navigator aft. His 'instrument panel' consisted of a compass and glass windows through which he could observe and communicate with the wheelhouse interior. There was no steering wheel in the cockpit. The S-26s were outwardly distinguished from the later S-38 Class by two trunk type ventilators positioned amidships on the centerline, and four large forced air vents. The 12 portholes – six per side – along the upper forward hull were deleted on this and subsequent classes.

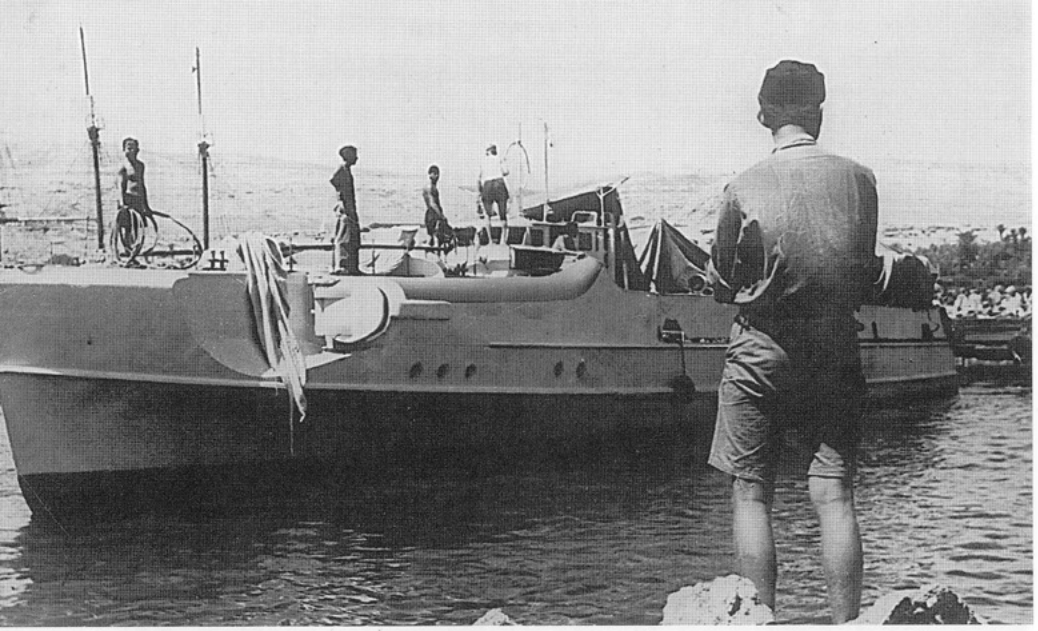
These boats were armed with a 2 CM Rheinmetall MG C/30 cannon on the afterdeck. The complement was 21 men. Lürssen built these vessels for the *Kriegsmarine* in 1939-40.

The *Kriegsmarine* deployed S-26, **S-27**, and **S-28** from the Baltic Sea to the Black Sea in early 1942. These three vessels cruised down the Elbe River to Dresden, Germany, where they were partially disassembled and moved overland to Ingolstadt, Germany. The *Schnellboote* were reassembled on the Danube River at Ingolstadt and sailed down the Danube to the Black Sea in Romania.


S-18 Class
Bridge Ahead of Wheelhouse
Exposed 53.3 CM (21 inch) Torpedo Tubes on Low Forecastle
Circular Ventilators
Portholes Along Upper Forward Hull
S-26 Class
Trunk Ventilators
Bridge Atop Wheelhouse
Torpedo Tubes Enclosed by Higher Forecastle
Portholes Deleted from Hull

**S-25 (right) is berthed alongside S-26 in a German port in May of 1940. The older vessel had exposed torpedo tubes and a low forecastle, compared to the enclosed tubes and higher forecastle of S-26 and later *Schnellboote*. Masts were removed from both vessels in a common wartime measure to reduce visibility. (Lürssen)**

**An S-26 Class boat moves at high speed in the wake of another *S-boot*. The enclosed forecastle design of this class provided added reserve buoyancy, increased crew space, and dryer conditions above decks. Inboard-hinged doors covered the torpedo tubes against sea spray until launch. (PT Boats, Inc.)**



**An S-30 Class vessel assigned to the *3rd 'Afrika' Schnellbootsflotille* (S-boot Flotilla) prepares for another mission. This Flotilla began operations in the Mediterranean Sea in December of 1941. The S-30s performed coastal patrols in support of the *Afrika Korps* in North Africa. (Mundt)**

**S-61 makes a show of force at the Piazza San Marco in Venice, Italy. It and S-54 limped out of fuel into Venice harbor to demand and receive its surrender to the Germans on 12 September 1943 – four days after Italy's armistice with the Allies. *Oberleutnant zur See* (Lt) Klaus-Degenhard Schmidt – S-54's *Kommandant* (Commander) – led 40 men of both boats and negotiated the peaceful surrender of Venice's 10,000 man garrison. He became Military Governor of Venice and was awarded the Knight's Cross. (Lürssen)**

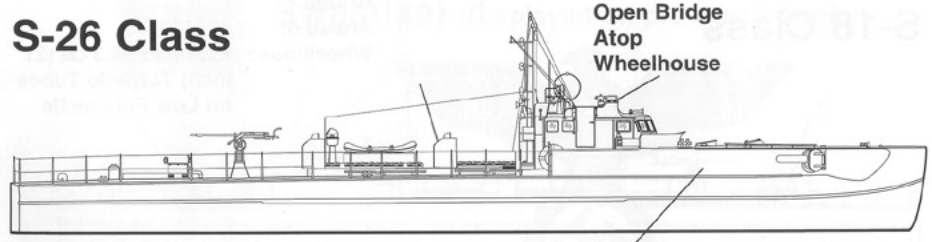
# S-30 Class (S-30 through S-37 & S-54 through S-61)

Lürssen developed the **S-30** Class contemporaneously with the more modern S-26 class. These boats were originally built for the Chinese Navy in 1939, but were commandeered to meet the *Kriegsmarine*'s own urgent wartime requirements. They had similar internal arrangements to the S-10/S-13 classes, with the less powerful 2000 HP Daimler-Benz MB 502 engines. The S-30s were modernized to integrate the torpedo tubes into the covered forecastle, but retained the open bridge and enclosed wheelhouse of the pre-war boats. The bridge of these vessels was especially wet since there was little to obstruct the flow of water from the bow into the control position. Distinctive upswept flanges port and starboard of the wheelhouse protected the torpedo crew from sea spray.

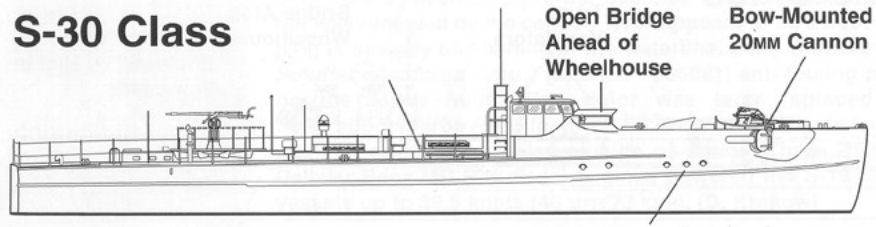
The S-30 Class boat was 32.8 M (107 feet 7.3 inches) long, with a beam of 4.9 M (16 feet) and a draught of 1.2 M (4 feet). It displaced 77 tons (70 MT) and had a top speed of 36 knots (42 MPH/67 KMH). It was armed with two 53.3 CM (21 inch) torpedo tubes in the forecastle and single 2 CM cannon in the bow and afterdeck. Each vessel was crewed by 16 officers and men.

The S-30 Class' design subsequently proved advantageous in that they were just small enough to navigate the Rhine-Rhône canal system, which enabled transit from the North Sea to the Mediterranean Sea. These boats were deployed to the Mediterranean in support of the German *Afrika Korps* from October of 1941. Some S-30s were modified in theatre with wheelhouse armor and additional weapons, including a 2 CM *Drehkranzlafette* (circular track gun mount) in the bow, a 2 CM *Drilling* (triple mount) amidships, and a 2 CM *Zwilling* (twin mount) aft.

## S-26 Class




## S-30 Class



**An S-30 Class boat cruises in the Mediterranean. Its Penguin motif on the upper hull was part of the menagerie of sea creatures identifying individual boats of the *3rd 'Afrika' S-bootsflotille*. S-30s were retrofitted with a bow-mounted 2 CM cannon, which provided additional firepower against enemy aircraft and surface targets. Lürssen built the first eight vessels of this class (S-30 to S-37) for a Chinese order, but the *Kriegsmarine* commandeered the boats when war broke out in 1939. (D. Krakow)**

# The *'Lürssen Effekt'* (From a 1946 US Navy Technical Report)

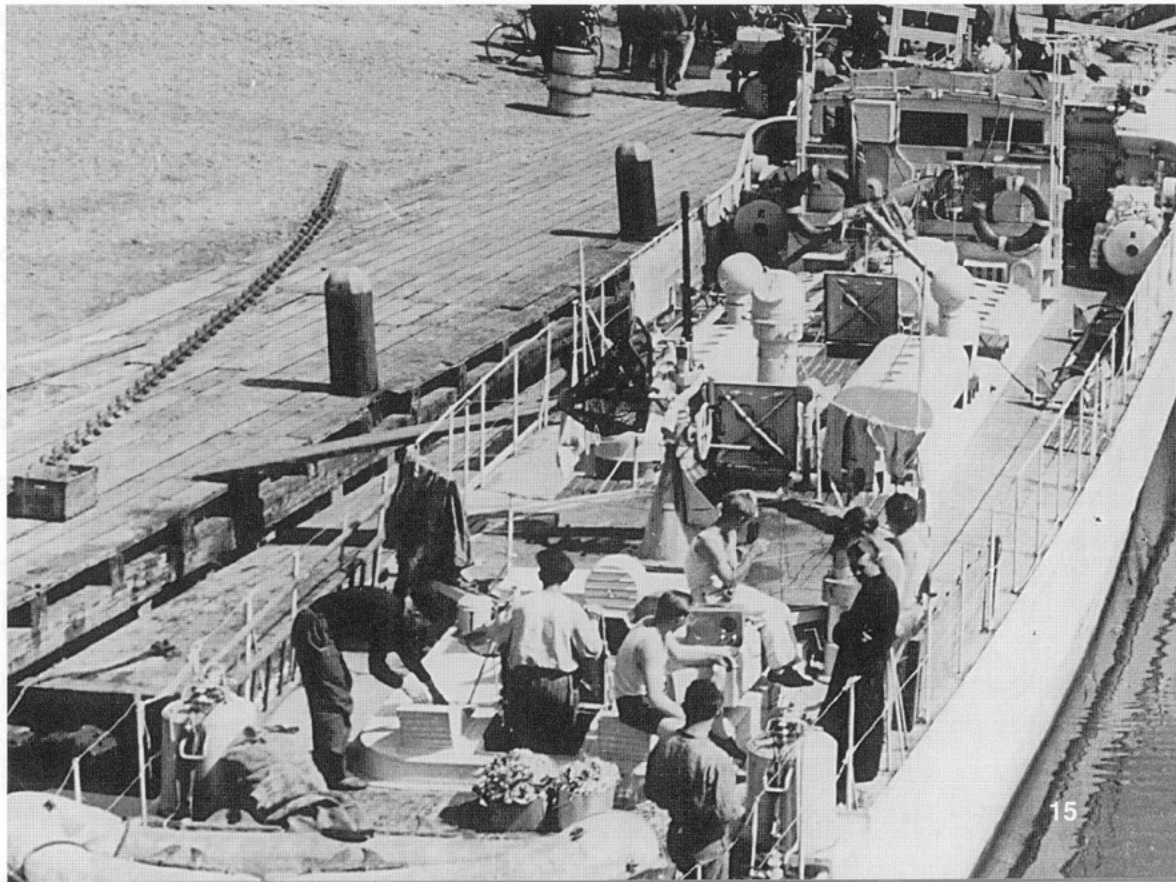
"The wing rudders are used to establish the 'Lürssen effect.' These rudders are equipped with levers connected to the main rudder by drag links or rods, which cause the rudders to rotate with the main rudders. This effect, only observed at a speed of about 25-28 knots [29-32 MPH/46-52 KMH], is based on the flow characteristics in the vicinity of and aft of the propellers. By swinging out the airfoil-shaped side rudders to about 30 degrees, a sudden flow breaking takes place inside the wake and an air-filled hollow space is created so that the direction and acceleration of the water as well as the stern trimming of the vessel is changed.

The following effects are created:

The engine revolutions are lowered by about 80 [revolutions] per minute (R.P.M.) or the power rises at constant R.P.M. due to the retained wake. The propeller efficiency is improved, and with engine speed held constant the ship's speed is increased by one knot.

The high stern wave ('cock's comb') which lifts at about 10 meters [33 feet] behind the vessel is flattened and the other waves lowered considerably. The stern trim of about 2 degrees at maximum speed is removed so that the vessel runs nearly horizontal.

The swinging out of the side rudders is done by means of a handwheel in the after engine room at the desired speed and helm angle. As stated above, to establish this effect the wing rudders are moved to an angle of 30 degrees outboard, after which they are swung inward to an angle of approximately 17 degrees to obtain optimum results at speeds of 28 to 40 knots [46 MPH/74 KMH]. If the speed of the vessel falls below 20 knots [23 MPH/37 KMH], this effect must be re-established at 28 knots before returning to full speed."



**Several members of S-59's crew congregate on the aft deck while their *Schnellboot* is moored at Hoofden, the Netherlands, in May of 1941. An inflatable life raft is mounted at the stern for crew transfer and evacuation. The 2 CM gun is pointed fully vertical while the vessel is in port. Aft torpedo tube doors flank the boat's wheelhouse. (D. Krakow)**

**An S-38 Class vessel cruises in moderate coastal waters. It has a fresh coat of *Schnellbootweiss* and dark gray decks. The dark gray boot topping above the red anti-fouling paint hid oil stains. *Schnellboot* crews generally kept their boats remarkably clean. (PK Krönke via PT Boats, Inc.)**

**An S-38 class boat moves through the water as sunlight filters through gaps in the cloud cover. It is armed with the first pattern bow 2 CM gun in a simple Scarff ring. This weapon became standard in the bows of later *S-boote*. A second 2 CM cannon is located on the afterdeck. (F. Urbans via David Krakow)**

# S-38 & S-38b Class (S-38 through S-53, S-62 through S-99, S-101 through S-135, and S-137 through S-138*)

The **S-38** Class was a continuation of the S-26 series. Construction of the lead boat, S-38, began in 1939 and it was commissioned in 1940. The early S-38s were highly similar to the S-26s, however, they were continuously modified according to experience. With three large trunk type ventilators over the engines, the S-38 Class finalized the ventilation arrangement that had been the subject of much experimentation in earlier classes. A more significant design change was an increase in firepower to counter steadily increasing enemy MTBs and, particularly, Motor Gun Boat (MGB) opposition. Beginning in 1941, an additional 2 CM *Flak*[1] in a Scarff ring[2] was mounted into a recess in the forecastle. In many cases, the aft weapon was upgraded from the standard 2 CM weapon to a 4 CM Bofors cannon. These modifications were not uniform and were made according to the needs of the boats' deployment area. With the additional crew needed to man the *Flak* guns, these boats had a complement of approximately 30 men, and an occasional dog. The Germans transported 11 S-38 Class boats by canal, river, and road to the Black Sea in early 1942.

Each S-38 Class *Schnellboot* was 35 M (114 feet 10 inches) long. It had a beam of 5.1 M (16 feet 9 inches) and a draught of 1.5 M (5 feet). The boat displaced 92.5 tons (84 MT) standard and 115 tons (104 MT) fully loaded. Three 2200 HP Daimler-Benz MB 511 12-cylinder, inline, liquid-cooled diesel engines powered the vessel. This powerplant enabled the S-38 Class to reach a maximum speed of 39.5 knots (45 MPH/73 KMH).

Standard armament for this class was two 53.3 CM (21 inch) torpedo tubes mounted in the upper bow, with two to four torpedoes carried – one in each tube, and when necessary, two reloads in the racks along the deck sides. A 2 CM cannon was mounted in the bow ,and either a 2 CM or a 4 CM cannon located on the aft deck.

Experiments with **S-67** attempted to reduce the boat's silhouette by adding an 8MM thick Plexiglas dome fitted around the bridge and wheelhouse areas. This was found to be impractical due to the material's reflective quality. Continuing the S-67 experiment, **S-68** was given a metal alloy dome. Although this design was successful, the dome was difficult to manufacture. A more practical version was made from faceted sheet metal plates. It had an armored center section of 10-12MM thick Wotan armor plating steel, a front bulkhead of 10MM steel, and an aft bulkhead of 8MM steel. The armored bridge's additional weight reduced speed by approximately three knots (4 MPH/6 KMH).

The armored dome, nicknamed *Kalotte* (Skull Cap), was standardized in late 1942, due to increasing casualties among bridge crews. The result was the **S-38b** Class – all of which were delivered from the yards with the armored *Kalotte* fitted in place. Most boats after S-68 were planned to be S-38bs; however, this policy was not consistent.

*S-38 Class boats 101 and upward were built between 1940 and 1943, concurrently with the lower numbered S-38 Class boats.

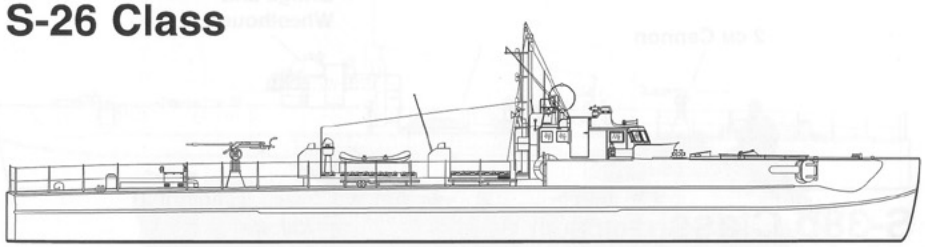
[1] *Flak*: *Flugabwehrkanone*; Anti-Aircraft Gun.

[2] Scarff ring: A hand-aimed machine gun or cannon mount utilizing a ring mounted on an elevating U-shaped frame. This mount was developed by the British for their aircraft during World War One.

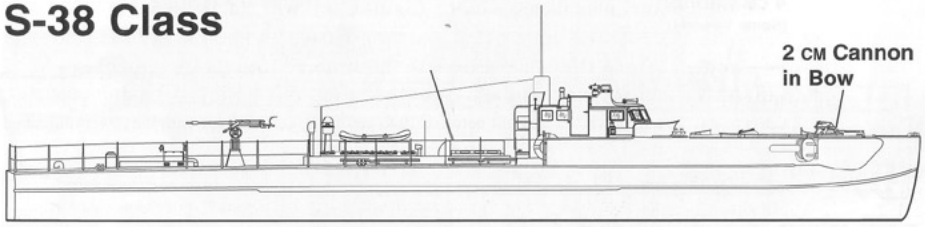
**Crewmen stand watch while an S-38 Class boat is on a North Sea coastal patrol mission. The panther insignia of the *4th S-bootsflotille* is painted on the upper hull below the wheelhouse. A wavy H personal emblem is located on the wheelhouse side. Canvas dodgers are deployed along the starboard railing. (PT Boats, Inc.)**

For example, while **S-76** – commissioned on 1 May 1942 – had the *Kalotte*, **S-95** – commissioned on 28 February 1943 – did not. Construction of the S-38 Class continued until **S-138**'s completion in July of 1943, when this design was superseded by the **S-100** Class.

## S-26 Class

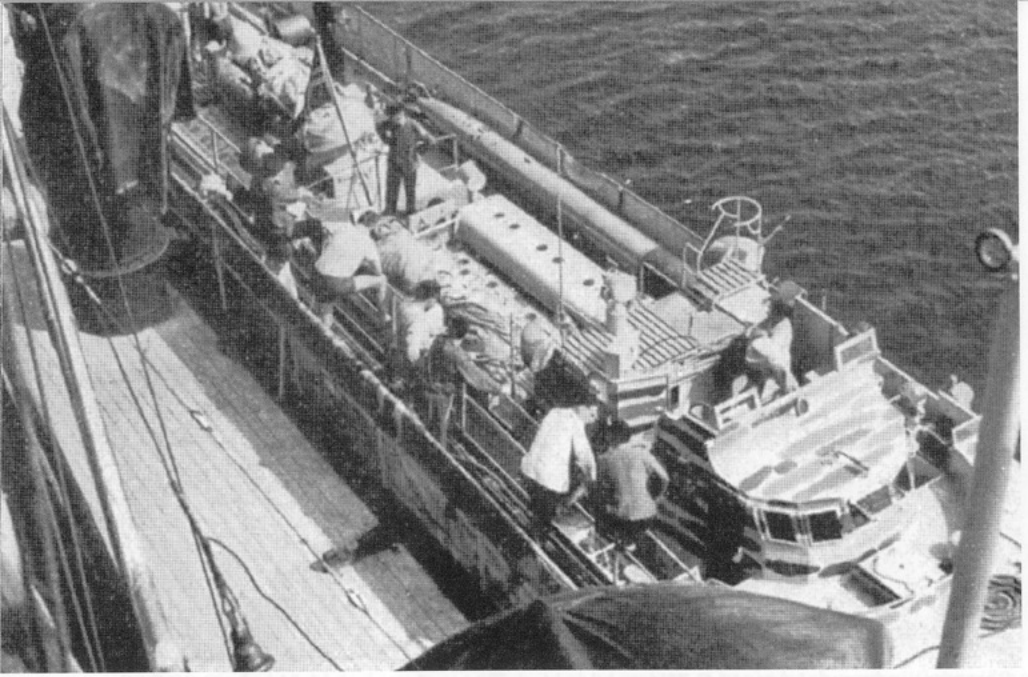


## S-38 Class



**Command personnel occupy S-73's open bridge. The center windshield is lowered; this was normally raised to help deflect sea spray from the bridge. A radio antenna mast is located on the starboard side, near a signal light. Patches of an unknown color have been painted over the *Schnellbootweiss* base color. Two of the personnel wear peaked caps, while the others have side caps. (E.J. Bakker)**

**(From left) Radioman, helmsman, and motorman stand watch in the wheelhouse of an S-38 Class boat deployed to Finland. The radioman wears headphones while communicating with either another vessel or with a shore base. The helmsman operates the helm (wheel) based on the commander's orders, while the motorman sends power commands to the engine rooms. (H. Burger)**

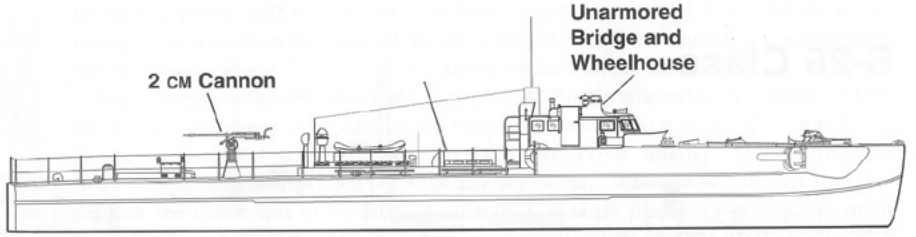


An S-38 Class boat replenishes from a supply ship in Norway. A tender was assigned to each *S-bootsflotille* to provide the boats with fuel, torpedoes, ammunition, food, and other supplies. This capability meant that *Schnellboote* did not have to rely solely on shore bases for replenishment and could extend their time on station. (H. Burger)

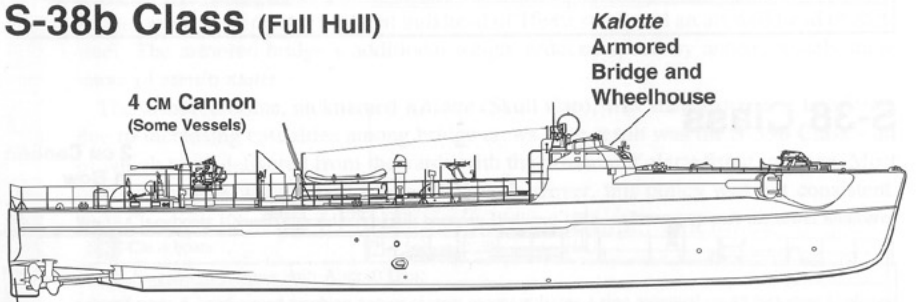
A standard S-38 Class boat is moored to port of an S-38b Class vessel. The latter has the streamlined *Kalotte* (Skull Cap) armored bridge, which became standard on this class. This *Kalotte* enclosed the bridge and wheelhouse areas with steel armor plates ranging in thickness from 8mm to 12mm. (F. Wiemers)

Crewmen gather on and immediately aft of S-91's bridge while out to sea. The crew acquired extra dinghies for their vessel; normally, only one dinghy was assigned to each *S-boot*. A canvas tarpaulin covers the 7.92mm *Zwillingsockel* 36 twin machine gun mount located amidships. (E.J. Bakker)

## S-38 Class (Waterline)



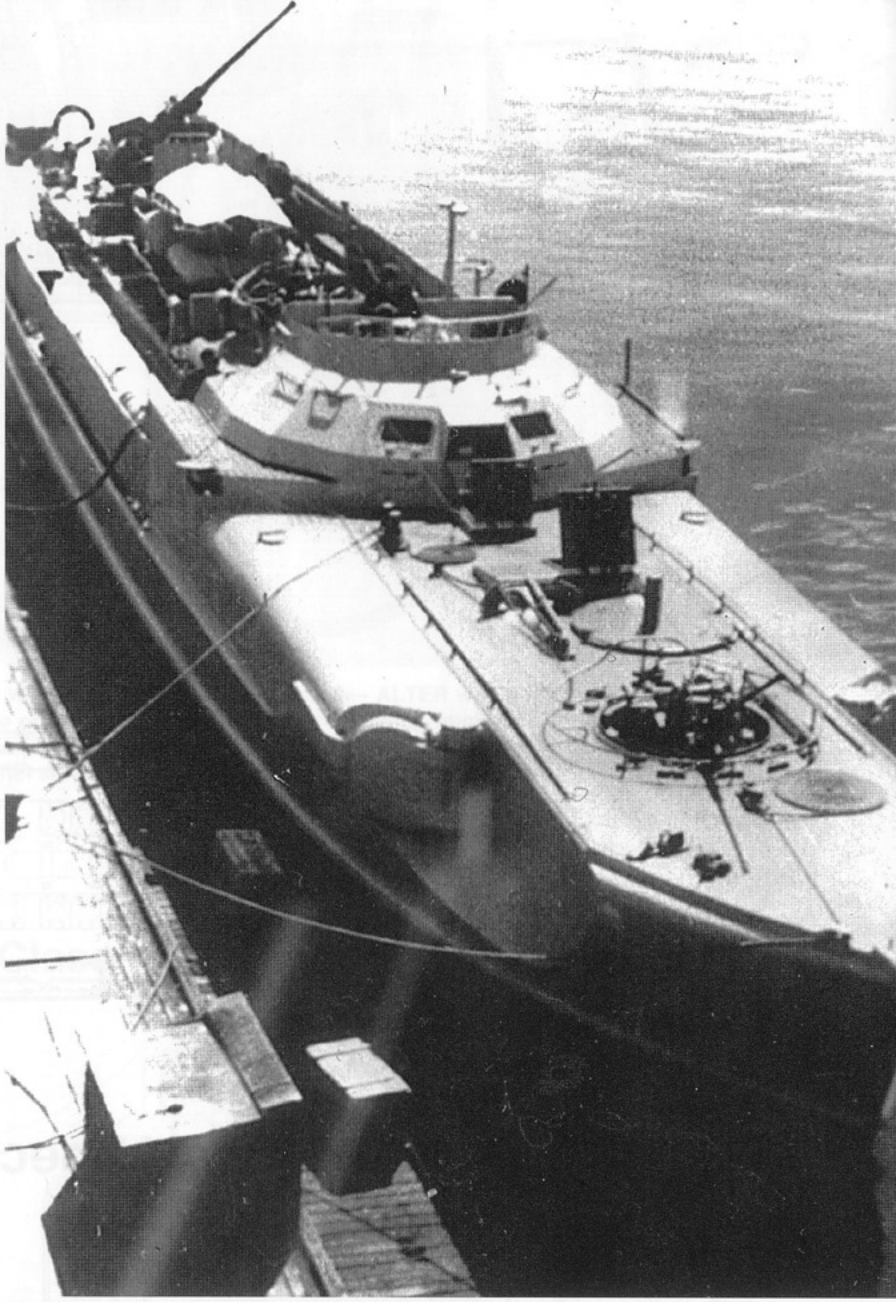

## S-38b Class (Full Hull)



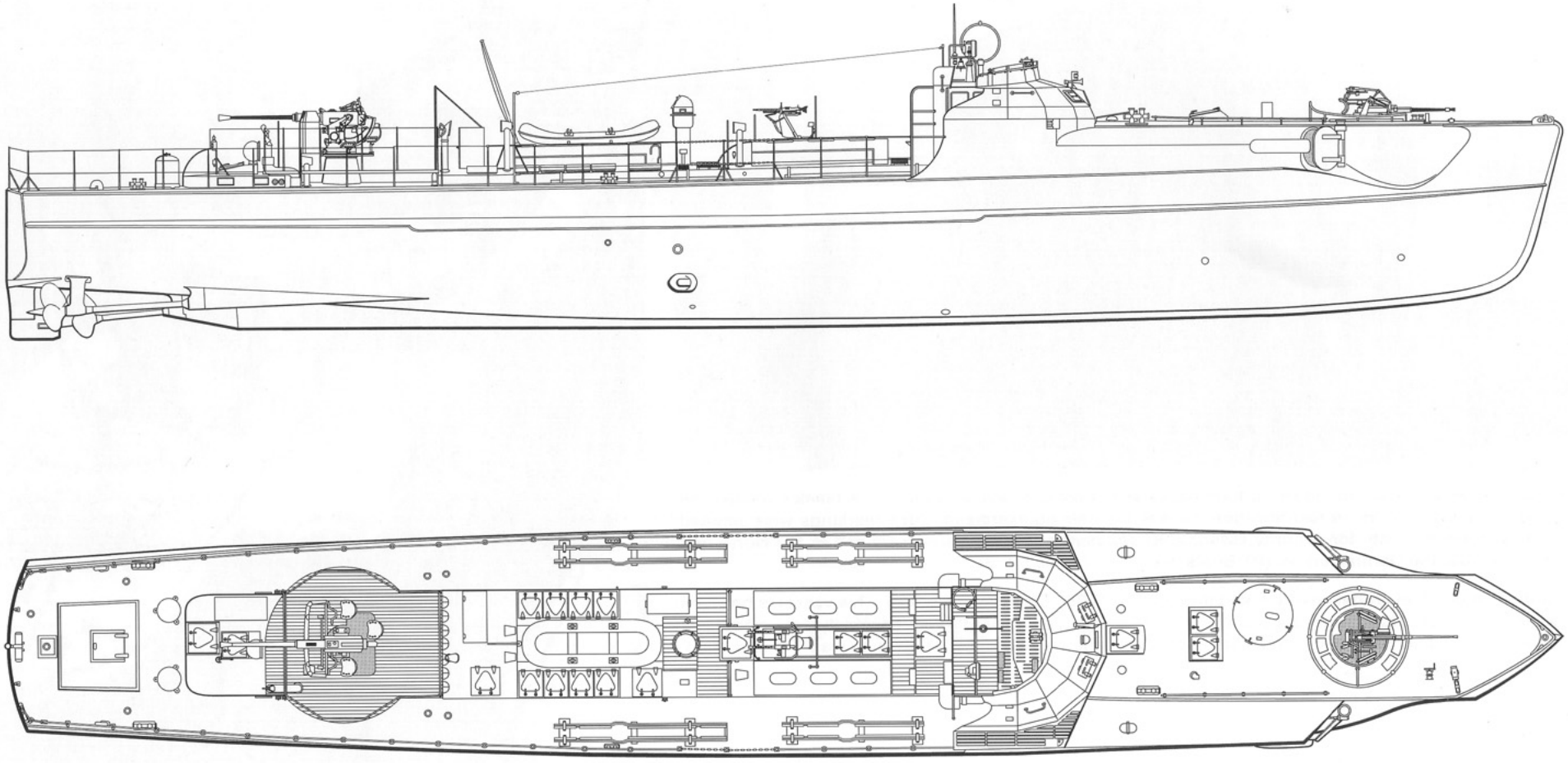

Large Main Rudder Flanked by Two 'Effect' Rudders (Port & Starboard)

An S-38b Class *Schnellboot* plows through heavy seas during a daylight patrol. The black 6 painted on the bow is believed to be an identification number for training exercises. Such markings were painted out on operational boats for security reasons. *Kriegsmarine S-boote* usually trained in the North and Baltic seas near the German coast. (PT Boats, Inc.)

A wartime censor has crudely overpainted the 6 on this S-38b Class vessel's bow. This vessel is believed to be the same boat pictured on page 3. The *Schnellboot* is moving at high speed and the lower bow lifts just above the water. Several crewman stand watch on the open bridge. (PK Krönke via PT Boats, Inc.)



An S-38b Class *S-boot* is moored at its base in 1943. A 2 CM C/38 cannon is mounted in the foredeck, while the open hatchway aft of this weapon provides access to the senior ratings' quarters. The small open hatch immediately forward of the bridge leads to the radio room (port) and captain's quarters (starboard). Canvas dodgers are placed over the port and starboard railings and a 4 CM cannon is located on the afterdeck. (F. Wiemers)



# S-38b Class *Schnellboot* Specifications

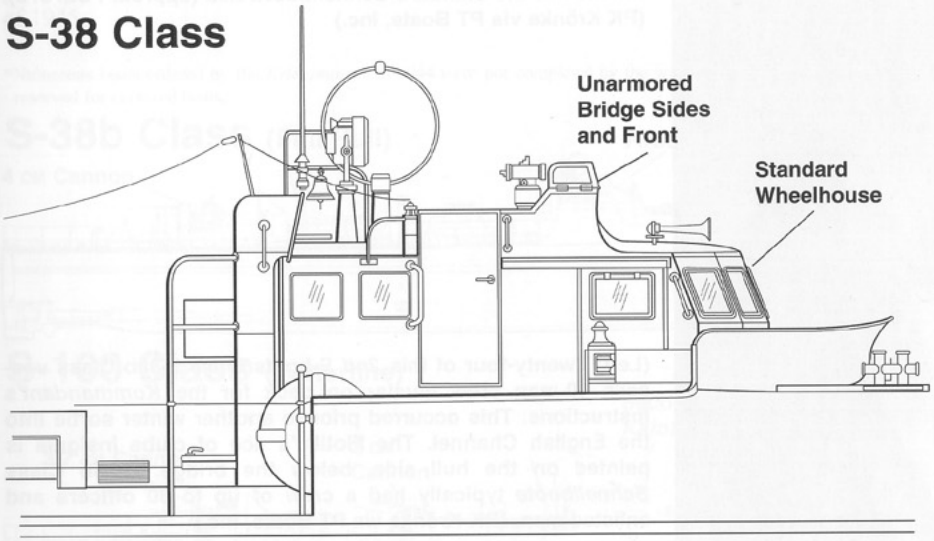
**Length:**.....35 M (114 feet 10 inches)
**Beam:**.....5.1 M (16 feet 9 inches)
**Draught:**.....1.5 M (5 feet)
**Displacement:**..92.5 tons (84 MT) standard, 115 tons (104 MT) full loaded
**Powerplant:**.....Three 2200 HP Daimler-Benz MB 511 12-cylinder, inline, liquid-cooled engines.
**Speed:**.....39.5 knots (46 MPH/73 KMH)
**Range:**.....700 nautical miles (806 miles/1297 KM) at 35 knots (40 MPH/65 KMH)
**Armament:**.....Two 53.3 CM (21 inch) torpedo tubes with four G7a, T3d, or T5a torpedoes in the upper bow; one 2 CM Rheinmetall MG C/38 cannon in bow; two 7.92MM MG34 machine guns in one *Zwillingsockel* 36 amidships; and one 2 CM MG C/30 or C/38 or one 4 CM Bofors *Flak* 28 cannon on aft deck.
**Crew:**.....21 to 30

S-91 wears a temporary camouflage for a daylight operation in June of 1944. It was highly unusual to see an armored bridge *S-boot* in camouflage or a whimsical ladybug mascot placed on the armored bridge. S-91's *Kommandant* (Commander) Heinz Nolte stands on the open bridge (third from left). (E.J. Bakker)

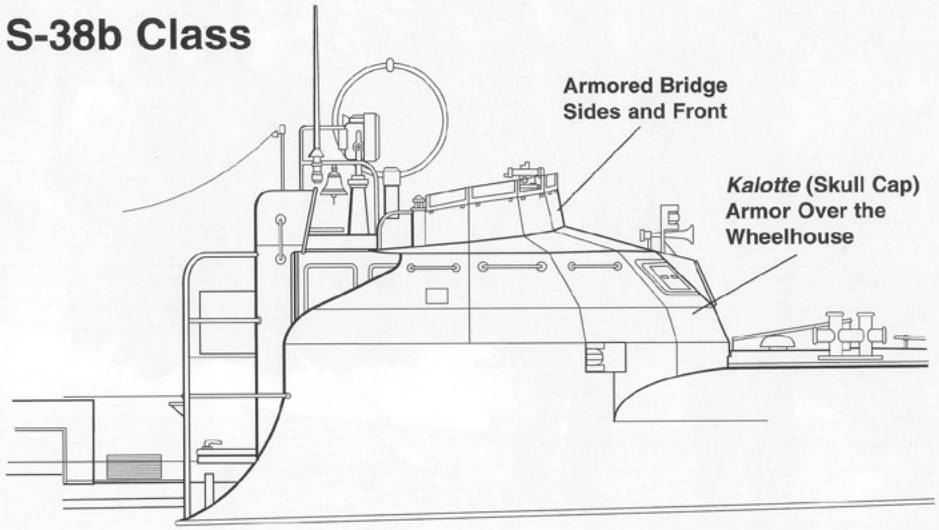
*Kommandant* Walter Knopp's personal insignia– ALTER within a stylized W – is painted on the *Kalotte* of his S-38b Class vessel. The leaping buck emblem of the *8th S-boots-flotille* appears on the wheelhouse side. This Flotilla operated in the North Sea and English Channel areas throughout the war (F. Wiemers)

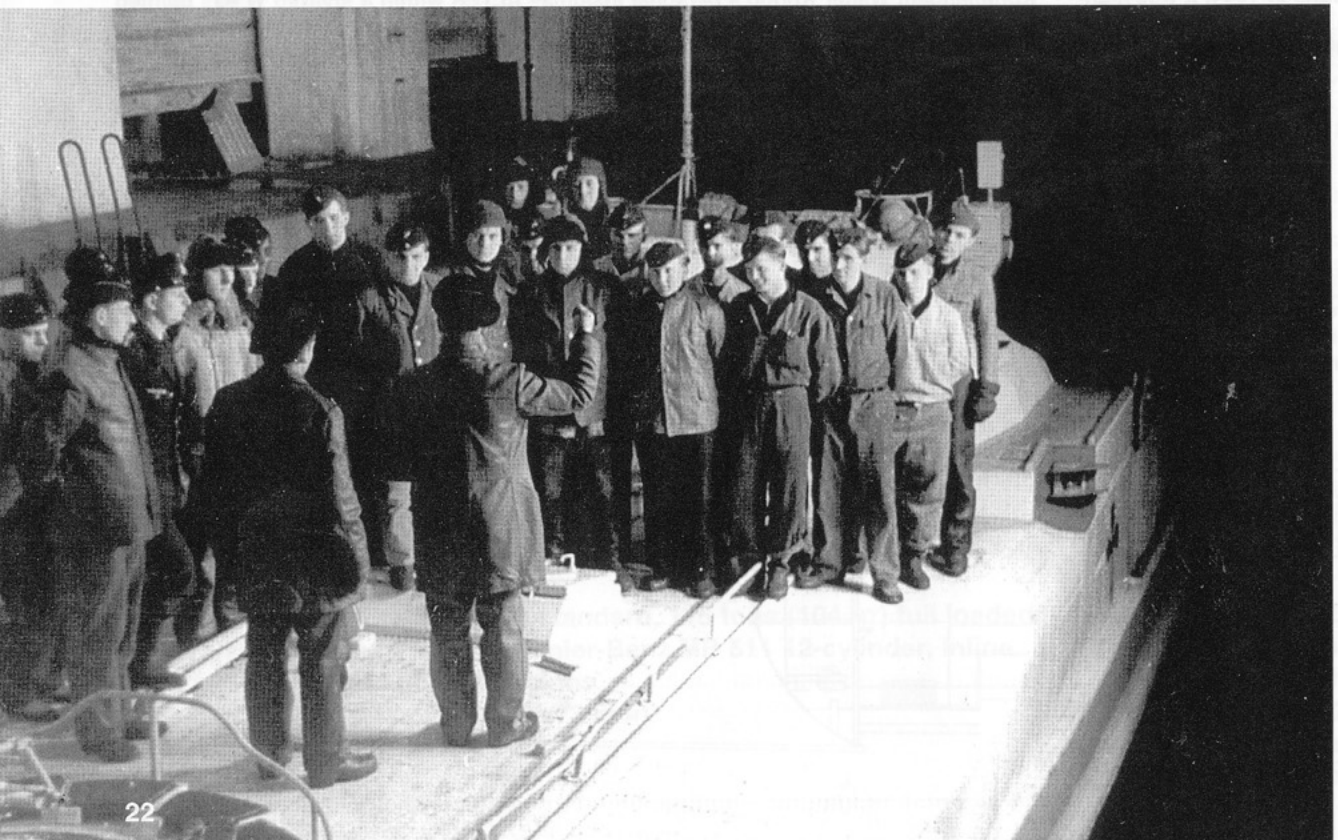
# Bridge Development

## S-38 Class




## S-38b Class





(Above) An S-38b Class *Schnellboot* plows through the sea on a combat mission. It is armed with one 2 CM *Flak* cannon in the foredeck, a 7.92MM *Zwillingsockel* (twin mount) 36 machine gun amidships, and another 2 CM weapon aft. The latter gun has a field-fitted gun shield installed. Canvas dodgers draped over the railings kept most sea water off the after deck. Horizontal surfaces and everything aft of the bridge were uniformly painted dark gray (approximately FS36081). Vertical surfaces were finished in the standard *Schnellbootweiss* (approx. FS27875). (PK Krönke via PT Boats, Inc.)

(Left) Twenty-four of this *2nd S-bootsflotille* S-38b Class vessel's 30-man crew muster on deck for the *Kommandant*'s instructions. This occurred prior to another winter sortie into the English Channel. The Flotilla's ace of clubs insignia is painted on the hull side, below the bridge. S-38b Class *Schnellboote* typically had a crew of up to 30 officers and enlisted men. (PK Krönke via PT Boats, Inc.)

# S-100 Class (S-100, S-136, S-139 through S-150, S-167 through S-228, and S-301 through S-305*)

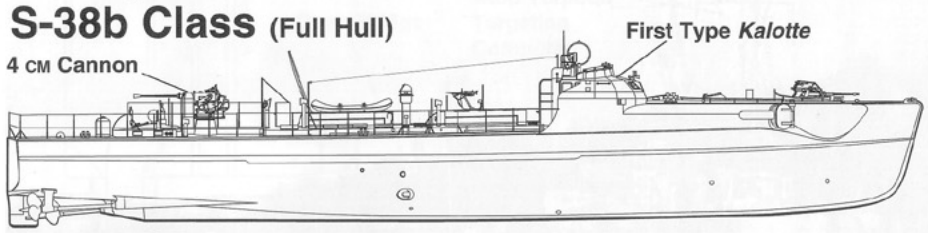
Based on intensive combat experience in the English Channel, the new S-100 Class design began commissioning in mid-1943. This was similar to the previous S-38 Class, but the S-100s were designed from the start with an armored *Kalotte* (Skull Cap bridge covering) and bow gun tub. Additional armor plate was provided for the engine superchargers.

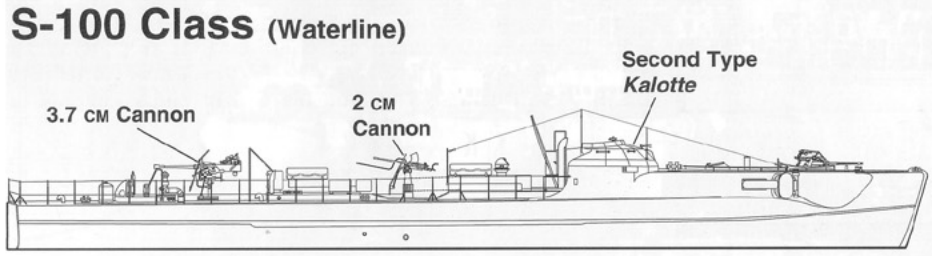
The S-100 Class retained the external dimensions of the S-38 Class. The new vessels were 35 M (114 feet 10 inches) long, with a beam of 5.1 M (16 feet 9 inches) and a draught of (1.5 M (5 feet). They displaced 100 tons (91 MT) standard and 117 tons (106 MT) at full load. The powerplant consisted of three 2500 HP Daimler-Benz MB 511 supercharged diesel engines. These enabled the boats to reach a maximum speed of 42 knots (48 MPH/78 KMH).

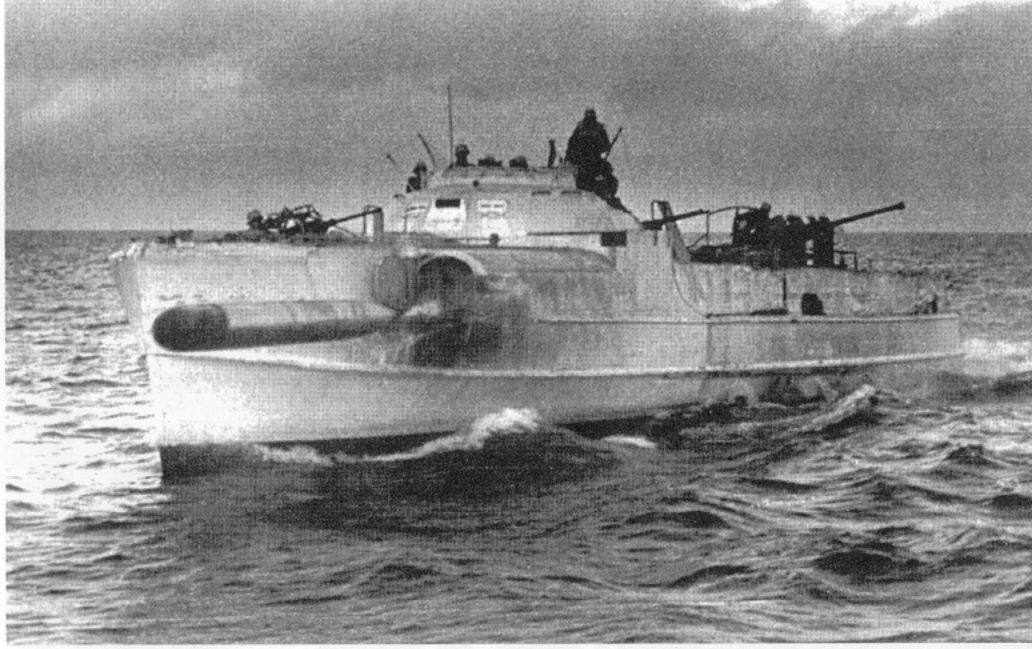
These *Schnellboote* were armed with two 53.3 CM (21 inch) torpedo tubes in the upper hull. One or two torpedoes were usually provided for each tube, depending on the situation, with one in the tube and reloads in the first rack aft of the tubes. The bow-mounted 2 CM cannon was retained, but secondary armament was upgraded to a 3.7 CM *Flak* aft and a twin 2 CM *Flak* amidships. A 4 CM gun sometimes replaced the 3.7 CM weapon. Other changes included simplification of the general arrangements to ease Germany's highly strained production capacity. For example, engine room skylights and other unnecessary fittings were removed.

S-219 introduced an increased fuel capacity, which gave these later boats a 750 nautical mile (864 mile/1390 KM) range at 35 knots (40 MPH/65 KMH). This was a 50 nautical mile (58 mile/93 KM) increase in range over earlier S-100 Class vessels. **S-226** was experimentally given a pair of rear-firing torpedo tubes and 3 CM Anti-Aircraft (AA) armament, the latter based on a Luftwaffe weapon, the MK103. **S-301** through **S-305** were to receive the MB 518 engine; however, production of these engines was cancelled. These boats also had a complement of approximately 30 men. **S-148** and **S-149** were deployed to the Black Sea in 1943. S-100 Class vessels were built from mid-1943 until near World War Two's conclusion in May of 1945.

*Numerous boats ordered by the *Kriegsmarine* in 1944 were not completed by the war's end; numbers 501-699 were reserved for captured boats.

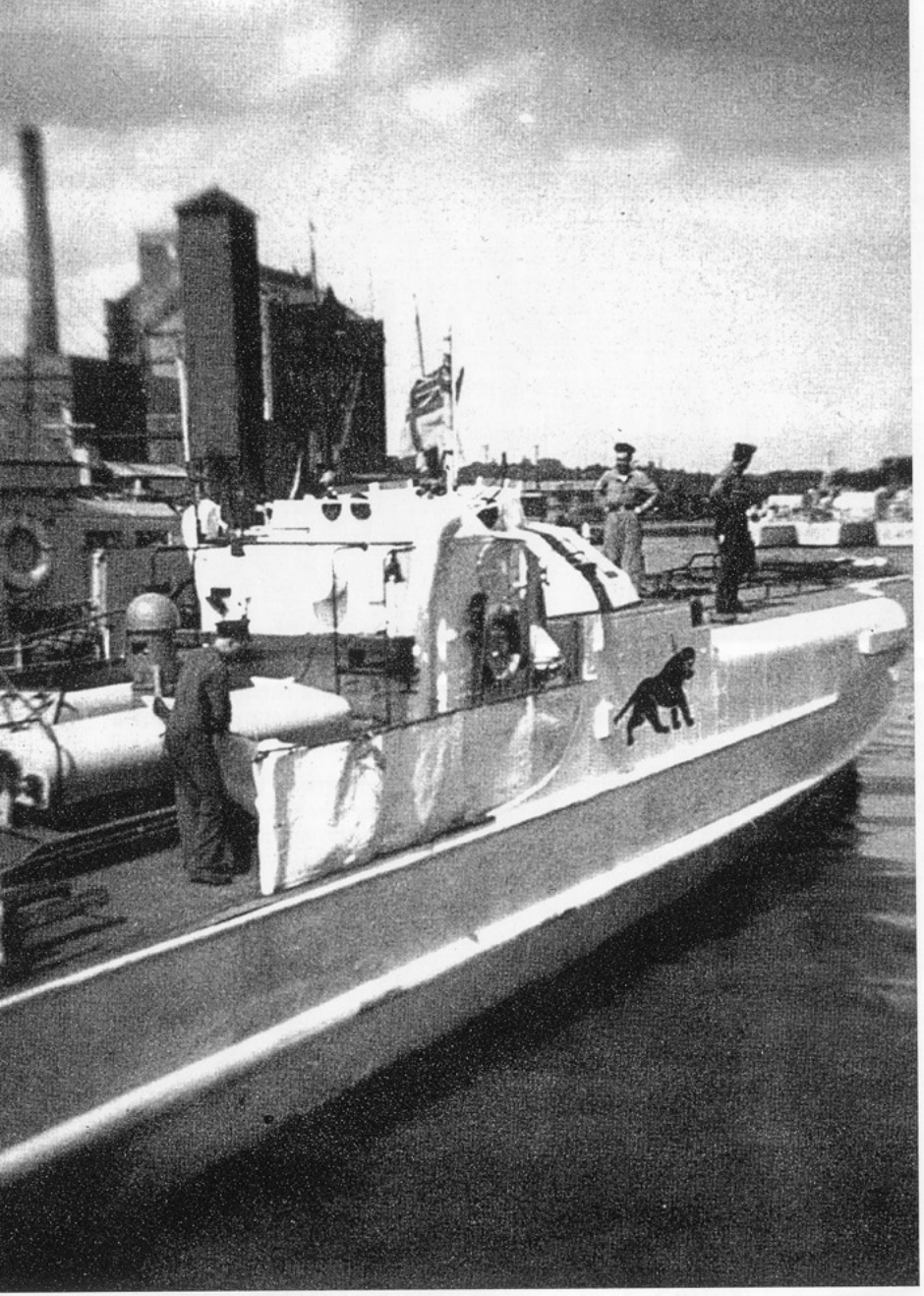


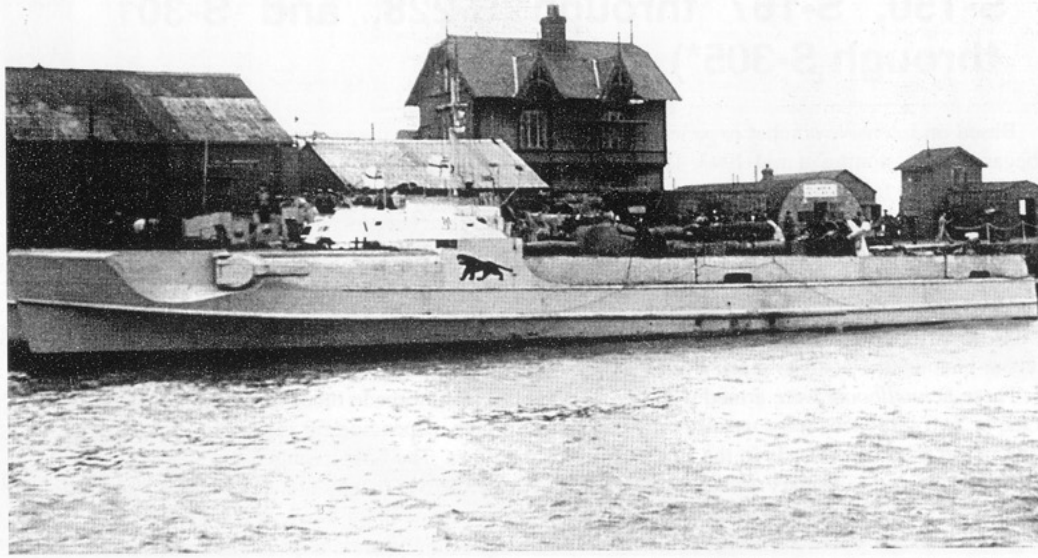



**S-206 launches a 53.3 CM (21 inch) torpedo from its port tube during a training exercise. Although an S-100 Class boat, it is atypically armed with a 4 CM Bofors cannon on the aft deck. S-100s usually had an aft-mounted 3.7 CM Rheinmetall *Flak* LM/42 cannon. (PT Boats, Inc.)**

**S-206 cruises at slow speed while on patrol. The open starboard torpedo tube door indicates enemy contact is expected. Each torpedo tube was reloaded in five minutes; however, hit-and-run attacks usually prevented this from occurring. The horizontal surfaces are painted a light gray, which is slightly darker than *Schnellbootweiss*. (PT Boats, Inc.)**



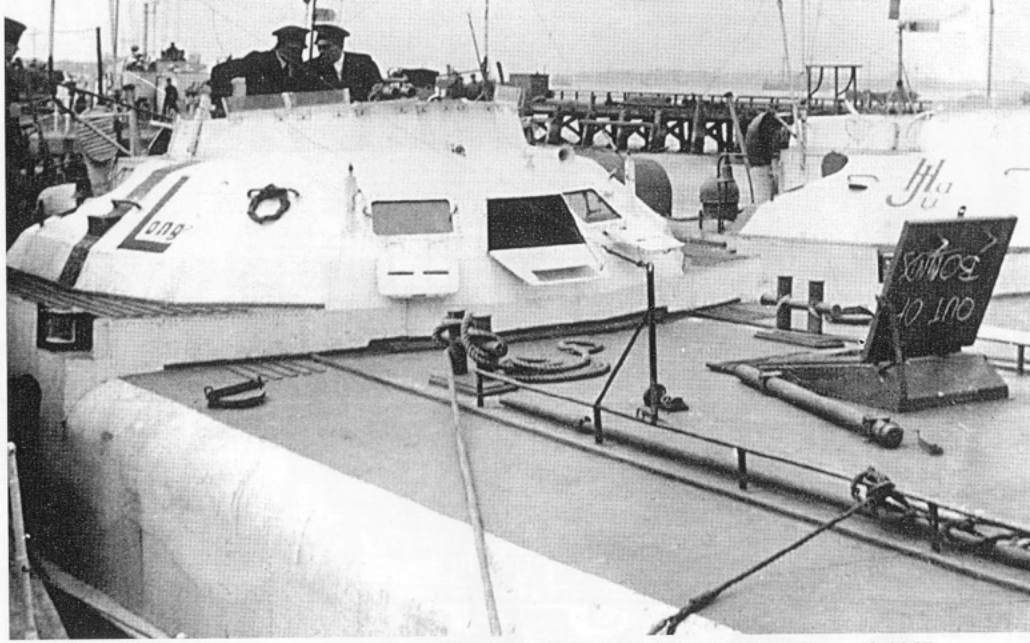
On 13 May 1945, the S-100 Class *S-boot* S-204 Lang earned the dubious distinction of being the first *Kriegsmarine* surface unit to surrender after World War Two ended in Europe. British sailors examine the boat while docked at Felixstowe, England. S-204 was assigned to the *4th S-bootsflotille*, whose panther insignia is painted on the hull side. (PT Boats, Inc.)



Ha-Jü was another 4th Flotilla S-100 Class boat to surrender to British forces. Canvas dodgers are draped over the railings of this craft while it is docked at Felixstowe. German unconditionally surrendered to the Allies on 8 May 1945, which became V-E (Victory in Europe) Day. (J. Lambert)

Three *S-boote* are berthed alongside the flotilla tender TANGA. This and other tenders provided *Schnellboote* with supplies, repairs, and crew quarters when they operated away from adequate port facilities. The gun shield in the foreground was mounted to a 3.7 CM cannon on an S-100 class vessel. (PT Boats, Inc.)

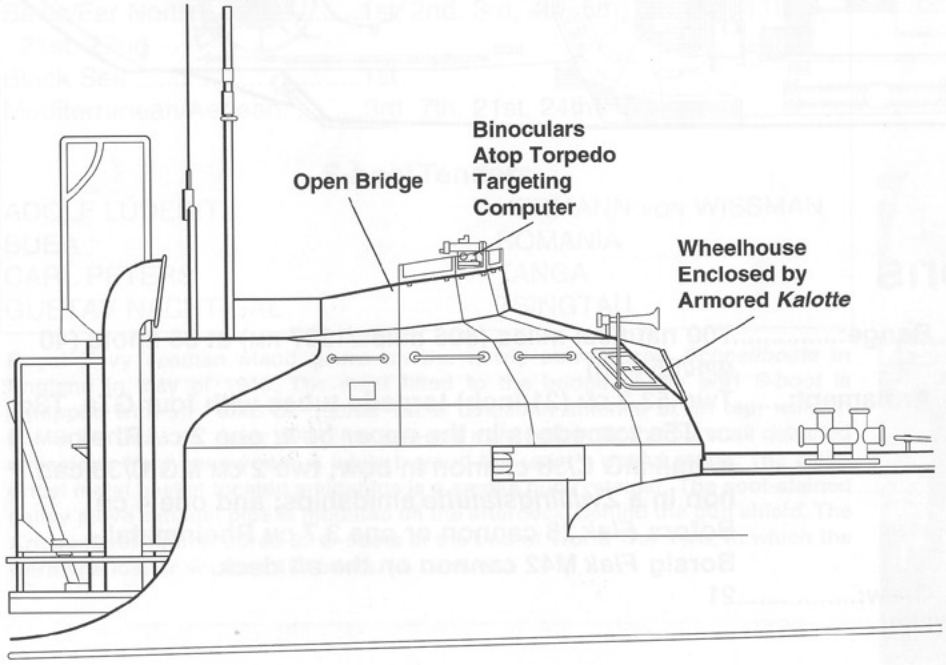
British officers on the open bridge help S-204's original crew guide Lang into Felixstowe after the surrender. The dark vertical stripe painted on the *Kalotte* was intended to hide boot scuffs. The S-100 Class was designed with the *Kalotte* as standard, unlike the retro-fitted armored bridge of the similar S-38b Class vessels. (R.W. Brown)

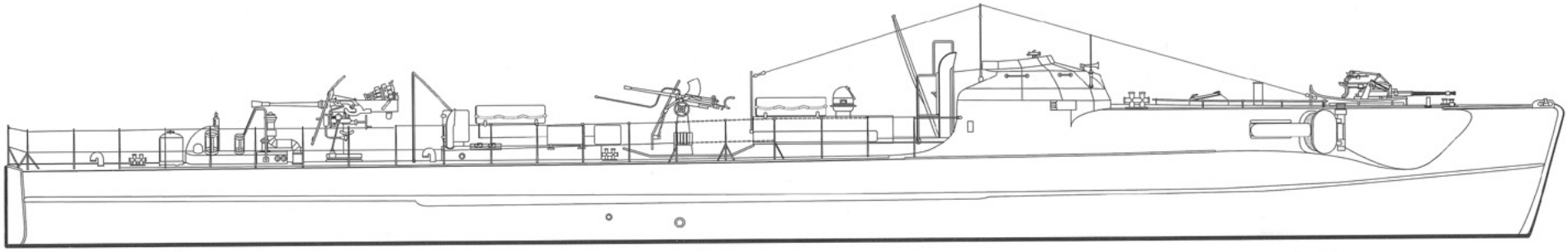


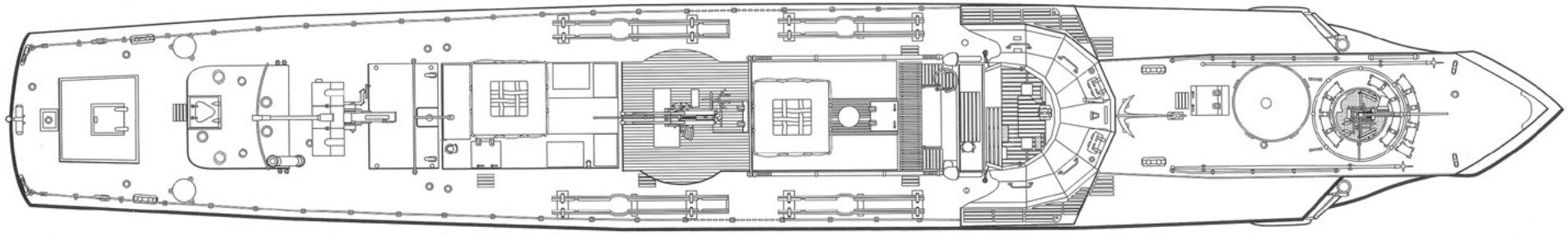

Two Royal Navy officers examine Lang after its arrival in Felixstowe in May of 1945. Hinged armor doors are lowered to reveal the center bridge opening and its two flanking windows. The 2 cm bow gun barrel is stowed inside the tube near the foredeck access hatch. (J. Lambert)

Crewmen examine S-188 after its gunfight with three Canadian corvettes off Normandy on 6 June 1944. KeK identifies its *Kommandant*, *Oberleutnant zur See* Karl-Eberhardt Karcher, who was wounded in that action. The crossed daggers (partially covered by a tarpaulin) indicated Karcher's Naval Academy graduating class of 1937. (D. Krakow)

## S-100 Class Bridge



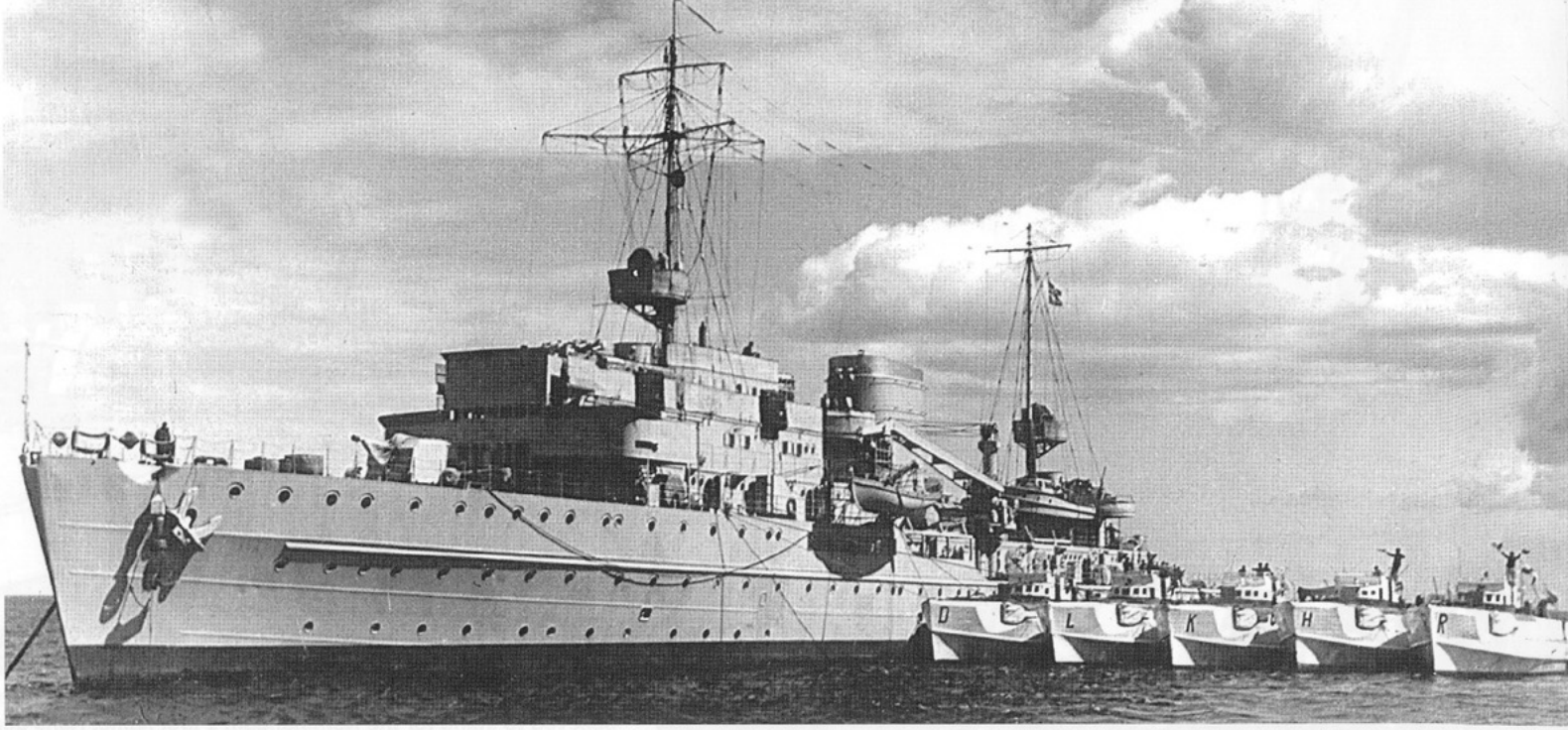




# S-100 Class *Schnellboot* Specifications

**Length:**.....35 M (114 feet 10 inches)
**Beam:**.....5.1 M (16 feet 9 inches)
**Draught:**.....1.5 M (5 feet)
**Displacement:**.100 tons (91 MT) standard, 117 tons (106 MT) fully loaded
**Powerplant:**.....Three 2500 HP Daimler-Benz MB 511 12-cylinder, inline, liquid-cooled engines.
**Speed:**.....42 knots (48 MPH/78 KMH)
**Range:**.....700 nautical miles (806 miles/1297 KM) at 35 knots (40 MPH/65 KMH)
**Armament:**.....Two 53.3 CM (21 inch) torpedo tubes with four G7a, T3d, or T5a torpedoes in the upper bow; one 2 CM Rheinmetall MG C/38 cannon in bow; two 2 CM MG C/38 cannon in a *Zwillingslafette* amidships; and one 4 CM Bofors *Flak* 28 cannon or one 3.7 CM Rheinmetall-Borsig *Flak* M42 cannon on the aft deck.
**Crew:**.....21

Five S-100 Class *Schnellboote* are berthed near the *S-boot* tender CARL PETERS. This 374 foot (114 M) long, 2900 ton (2631 MT) tender was commissioned into the *Kriegsmarine* on 6 January 1940. It was one of eight tenders available to support *S-boot* flotillas during World War Two. CARL PETERS was assigned to the *1st*, *5th*, and *6th S-bootsflotillen* (S-boot Flotillas) at various times during the conflict. Letters painted on the *S-boote*'s bows indicate that these boats were assigned to the *3rd S-bootsschule-flotille* (S-boot Training Flotilla) in the Baltic Sea in mid-1944. CARL PETERS was based near the Kurland Peninsula of Latvia during this assignment. A mine sank this ship on 14 May 1945. (PT Boats, Inc.)

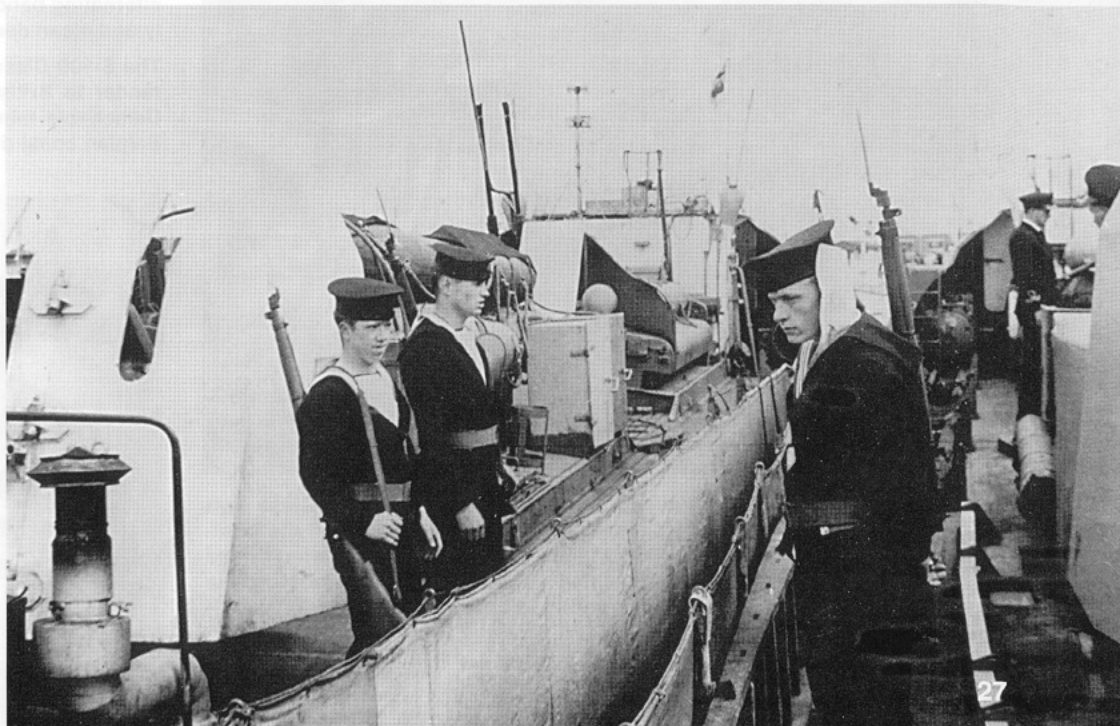


### *S-bootsflotillen* (*S-boot* Flotillas) and Their Operational Areas

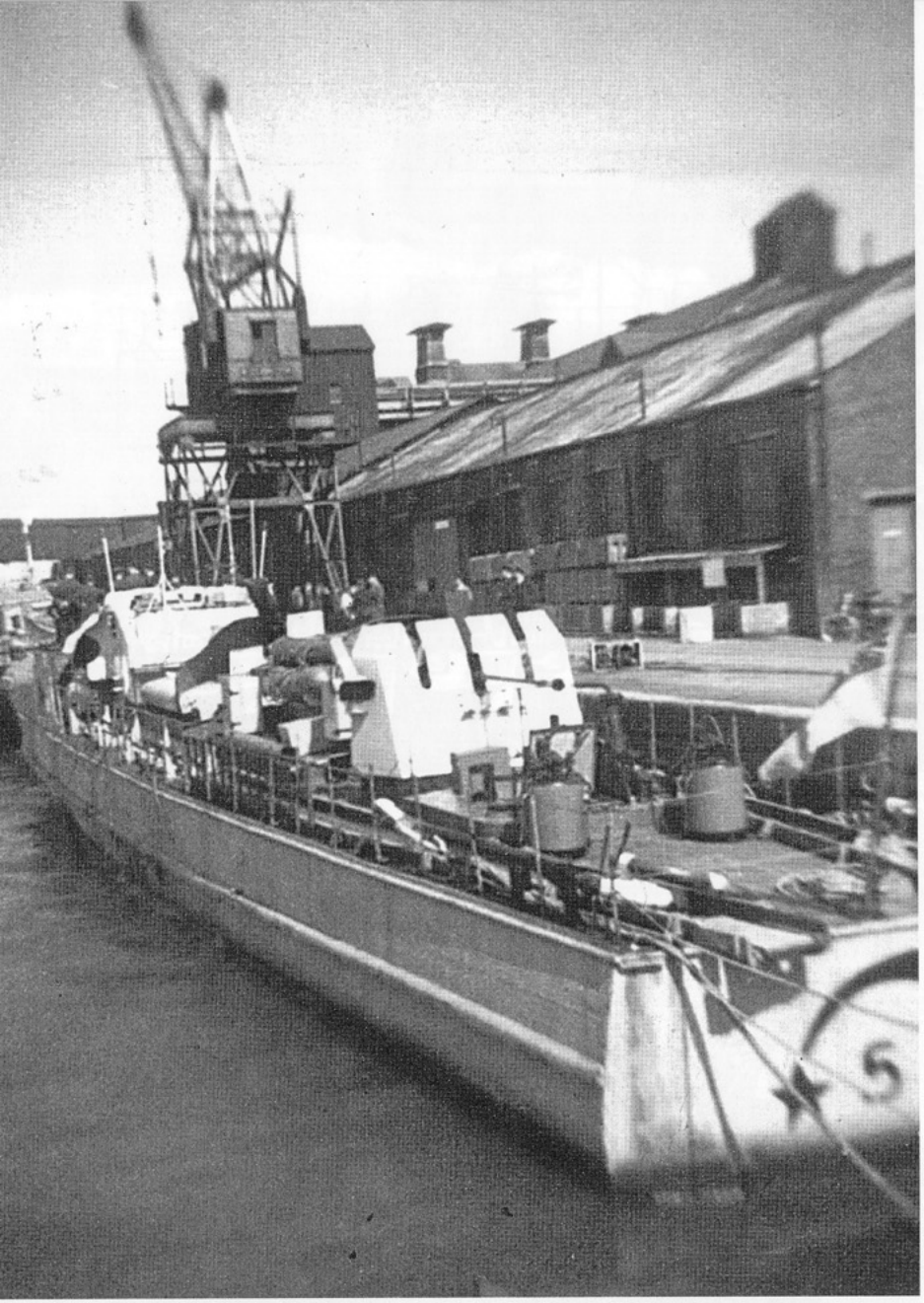
English Channel/North Sea:..1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th
Baltic/Far North:.....1st, 2nd, 3rd, 4th, 5th, 6th, 8th, 11th, 21st, 22nd
Black Sea:.....1st
Mediterranean/Aegean:.....3rd, 7th, 21st, 24th

### *S-boot* Tenders

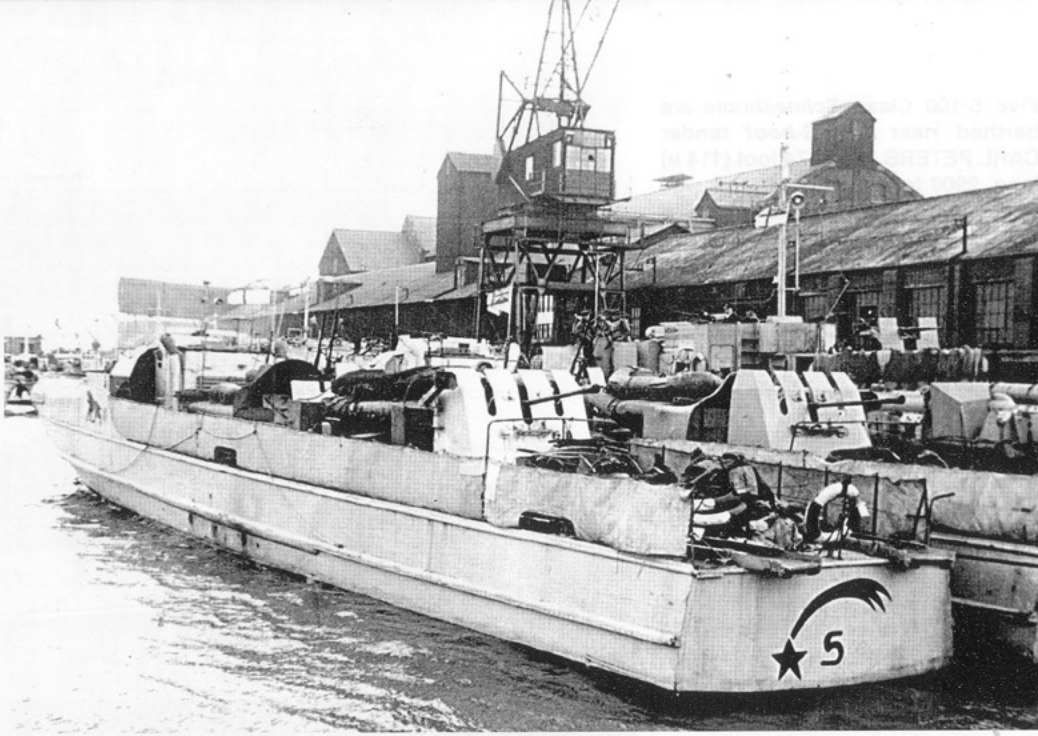
| | |
|---|---|
| ADOLF LÜDERITZ | HERMANN VON WISSMAN |
| BUEA | ROMANIA |
| CARL PETERS | TANGA |
| GUSTAV NACHTIGAL | TSINGTAU |



Royal Navy seamen stand guard on the newly surrendered *Schnellboote* in England in May of 1945. The mast fitted to the bridge of the port *S-boot* is equipped with an FuMB 32 *'Flores'* radar detection antenna at its top, with an FuMB 24 *'Cuba 1a'* radar detection antenna right below. Both antennas detected emissions from enemy radars while beyond the radar's useful range. The cylindrical metal basket located amidships is a smoke buoy retainer. The soot-stained galley stove exhaust pipe is mounted on the afterdeck, behind the gun shield. The *Kriegsmarine* surrendered 92 *S-boote* at the end of World War Two, in which the Germans lost or scuttled 157 boats. (J. Lambert)

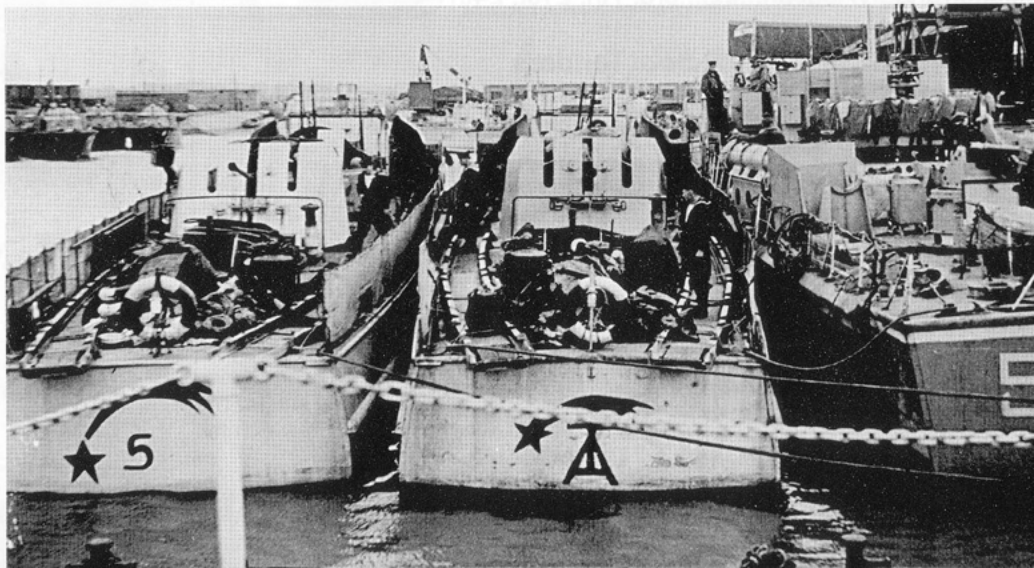


Canvas dodgers have been removed from the railings of the S-100 Class boat Ha-Jü at Felixstowe in May of 1945. Their absence reveals the mine rails located along the sides and the two cylindrical smoke dischargers mounted on the after deck. The comet and Gothic h painted on the stern is believed to be the vessel's radio call sign. *S-boot* numbers were left off wartime boats for security reasons. (PT Boats, Inc.)

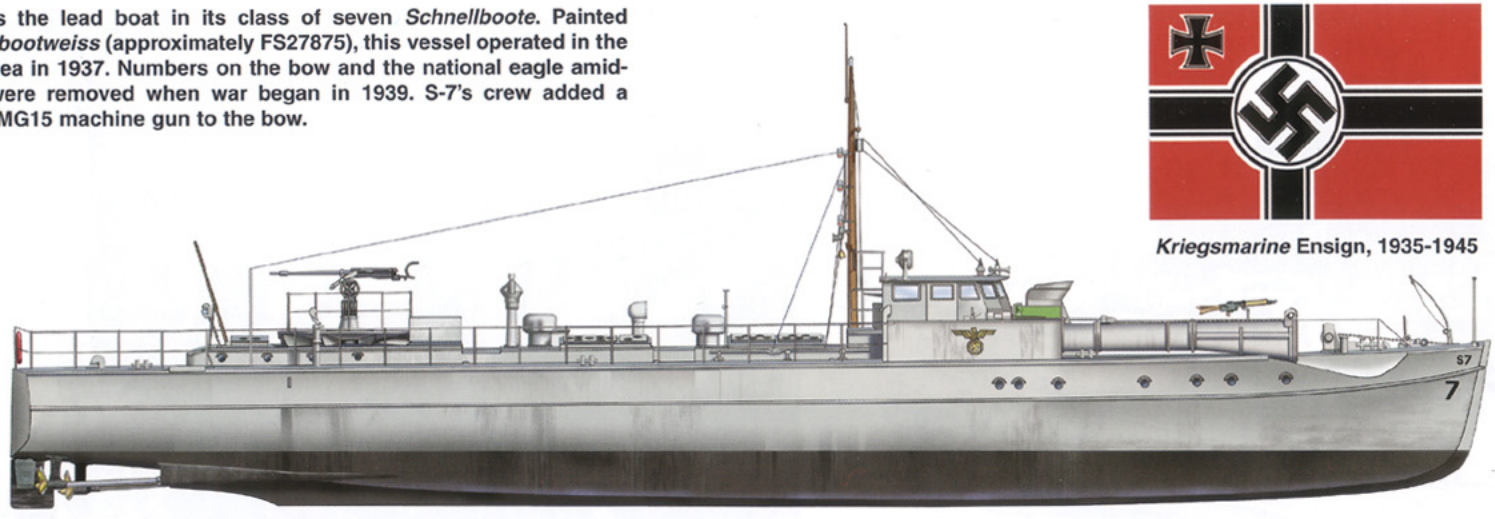


The canvas dodgers had not been removed when Ha-Jü first arrived at Felixstowe. This name is believed to stand for the *Kommandant*'s first name, Hans-Jürgen. Side armor was field-fitted to the 3.7 CM gun on the after deck. The usually solid red life preservers near the stern are decorated with alternating bands of red and *Schnellbootweiss*. Ha-Jü's British captors have left the normally orderly and clean decks in disarray. (J. Lambert)

The S-100 Class boats Ha-Jü (port) and Lang (starboard) are berthed side-by-side after their surrender to British forces in 1945. Lang's stern has the monogram TA painted under the comet. Detachable mine rails were fitted to both vessels' afterdecks. These *S-boote* laid mines off the Belgian coast during the final weeks of the war. (J. Lambert)



S-7 was the lead boat in its class of seven *Schnellboote*. Painted *Schnellbootweiss* (approximately FS27875), this vessel operated in the North Sea in 1937. Numbers on the bow and the national eagle amidships were removed when war began in 1939. S-7's crew added a 7.92MM MG15 machine gun to the bow.

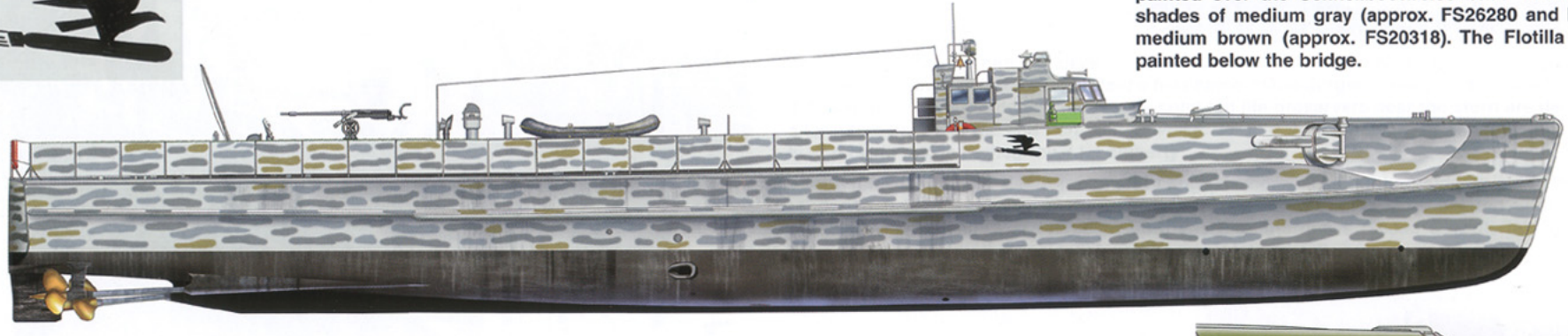




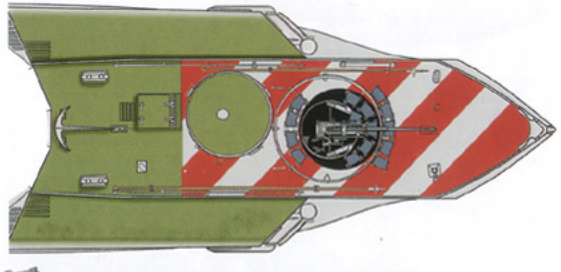

*Kriegsmarine* Ensign, 1935-1945

*S-boot* Uniform Badge

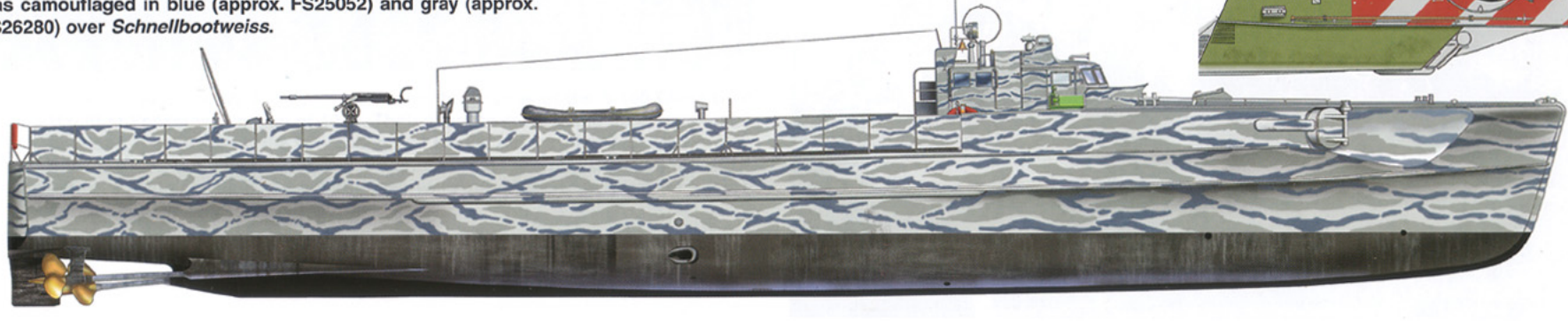
This early S-38 Class vessel was assigned to the *5th S-bootsflotille* (*Schnellboot* Flotilla) in the Baltic Sea in 1941. Splotches painted over the *Schnellbootweiss* base finish were in two shades of medium gray (approx. FS26280 and FS26440) and medium brown (approx. FS20318). The Flotilla insignia was painted below the bridge.



Red and *Schnellbootweiss* diagonal stripes were painted on the bows of *S-boote* deployed to the Black Sea in 1943. This marking was adopted from Italian practice and reduced the risk of 'friendly fire' from Axis aircraft. The rest of the upper deck was painted pea green (approx. FS34258).

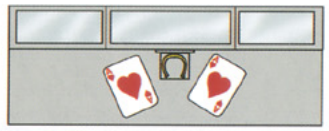


This S-38 Class *Schnellboot* was assigned to daylight operations against Soviet shipping in the Eastern Baltic in 1941. It was camouflaged in blue (approx. FS25052) and gray (approx. FS26280) over *Schnellbootweiss*.

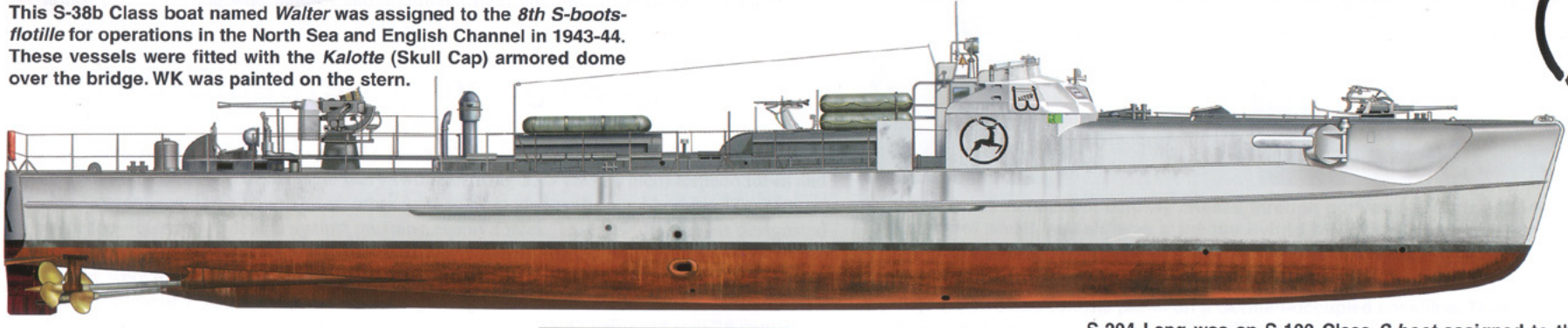


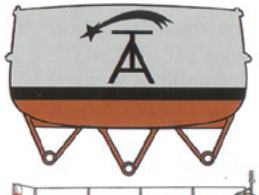
This late S-38 Class vessel was assigned to an *S-bootsflotille* operating in the English Channel in 1942. A 40MM Bofors cannon is mounted on the after deck for anti-aircraft and anti-surface vessel uses. Red (approx. FS20152) anti-fouling paint coated the boat's below waterline surfaces and replaced the earlier black-gray (approx. FS36081) anti-fouling paint.

Two 'Ace of Hearts' cards were painted on the wheelhouse front. These cards flanked a gold horseshoe talisman.

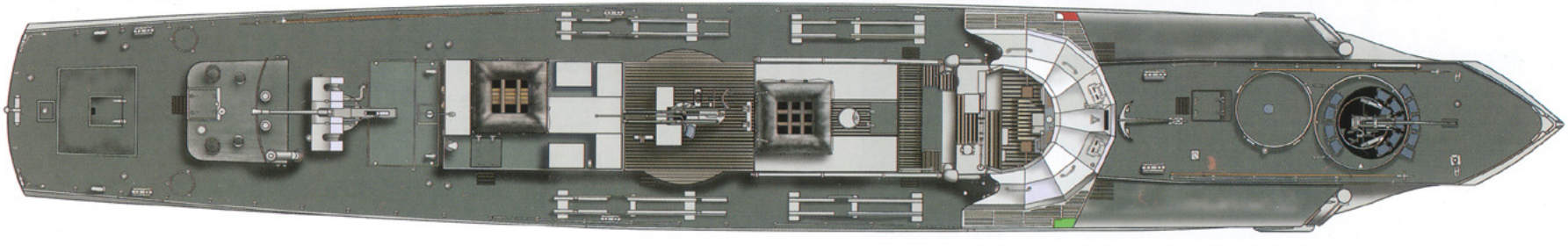


This S-38b Class boat named *Walter* was assigned to the *8th S-bootsflotille* for operations in the North Sea and English Channel in 1943-44. These vessels were fitted with the *Kalotte* (Skull Cap) armored dome over the bridge. WK was painted on the stern.





S-204 Lang was an S-100 Class *S-boot* assigned to the *4th S-bootsflotille* in 1944-45. Its deck was painted in a waterproof and wear-resistant dark gray (approx. FS26187). This finish also hid scuffmarks from the crew's boots. Two torpedo reload rails are mounted aft of each torpedo tube. A comet was painted above a TA monogram on the stern.



# S-151 Class (S-151 through S-158)

The **S-151** Class boats were a unique class of *Schnellboot* built from incomplete hulls of the Dutch torpedo boats **TM.54** through **TM.61**. German forces captured these eight vessels at the Gusto Werke in Scheidam, the Netherlands in May of 1940. These craft were based on a license-built British Power Boat design. German and Dutch workers completed the eight boats of this class by 1942. They were armed with standard German 53.3 CM (21 inch) torpedo tubes – replacing the Dutch 45 CM (18 inch) tubes – and a 2 CM *Flak*. The S-151s were 28.3 M (92 feet 10.2 inches) in length, with a beam of 4.46 M (14 feet 7.6 inches) and a displacement of 57 tons (52 MT). Their narrow beam allowed these craft to navigate the narrow European canal system and they were also deployed to the Mediterranean Sea. Field modifications included armor plate over the wheelhouses and additional light anti-aircraft weapons, including the 15MM *Drilling*. The S-151 Class had a top speed of 34 knots (39 MPH/63 KMH).

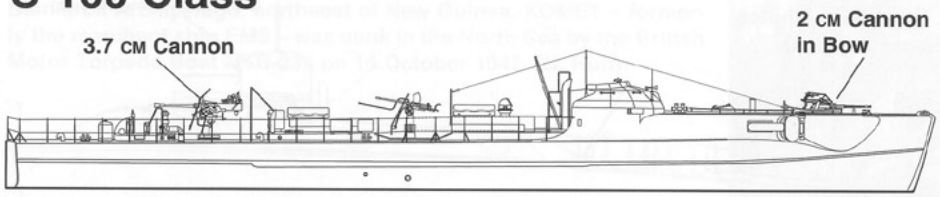
# S-700 Class (S-701 through S-709)

Experiments performed on the S-100 Class **S-226** led to a proposed new *Schnellboot* design in 1944. This craft was designed to carry two rear-firing 53.3 CM (21 inch) torpedo tubes and one 3 CM cannon in the bow. The aft tubes were to be loaded with sound-homing *'Zaunkönig'* torpedoes intended to defend against pursuing enemy forces. This new design was designated the **S-700** Class and nine boats were authorized.

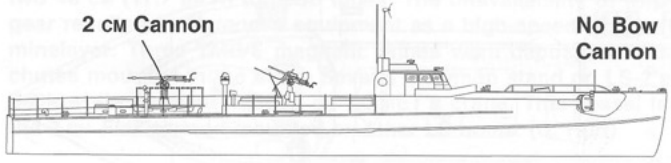
They were to have a length of 35 M (114 feet 10 inches), a beam of 5.1 M (16 feet 9 inches), and a draught of 1.5 M (5 feet). The intended powerplant was three 2500 HP Daimler-Benz MB 518 engines, which would allow the S-700 Class boat to reach 42 knots (48 MPH/78 KMH). The engines would also allow the boat's displacement to increase from 100 tons (91 MT) to 107 tons (97 MT). Its crew complement consisted of 23 men.

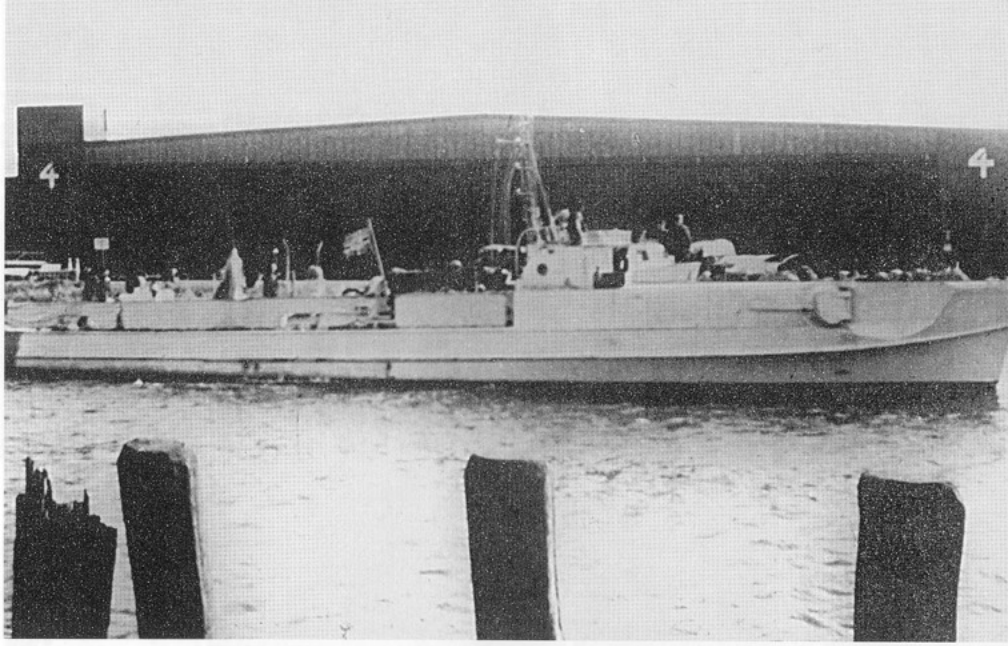
The MB 518's cancellation in August of 1944 resulted in the S-700 Class' termination in favor of additional S-100 Class *Schnellboote*. Plans for a *"Panzerboot,"* an armored gunboat version of the *S-boot*, were cancelled at the same time.

## S-100 Class




## S-151 Class



**An S-151 Class *Schnellboot* slowly cruises through port waters during World War Two. This class of small vessels was a unique hybrid of British-designed, Dutch-built, and German-equipped boats. German and Dutch shipyard builders completed eight S-151 Class *S-boote* between 1940 and 1942. (PT Boats, Inc.)**

**A pair of S-151 Class vessels patrol off a German-occupied coastline. These *S-boote* were small enough to navigate the narrow Rhine/Rhône canal system, which led from the North Sea to the Mediterranean. The S-151s were deployed to support the German *Afrika Korps*, which was fighting Allied forces in North Africa. (PT Boats, Inc.)**

Crewmen aboard the *Hilfskreuzer* (HK; Auxiliary Cruiser) KOMET hoist LS-2 from its hold forward of the bridge structure. This boat was one of three *Leichte-Schnellboote* deployed aboard German auxiliary cruisers. KOMET and nine other such vessels were armed merchant ships engaged in raiding Allied cargo ships throughout the world's oceans. (G. Huff)

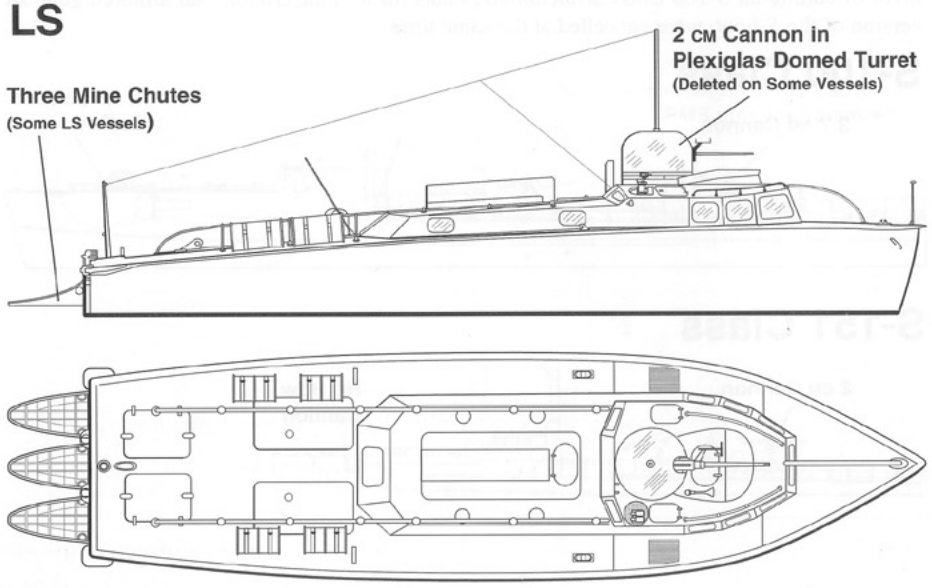
# *Leichte-Schnellboote* (LS-1 through LS-12)

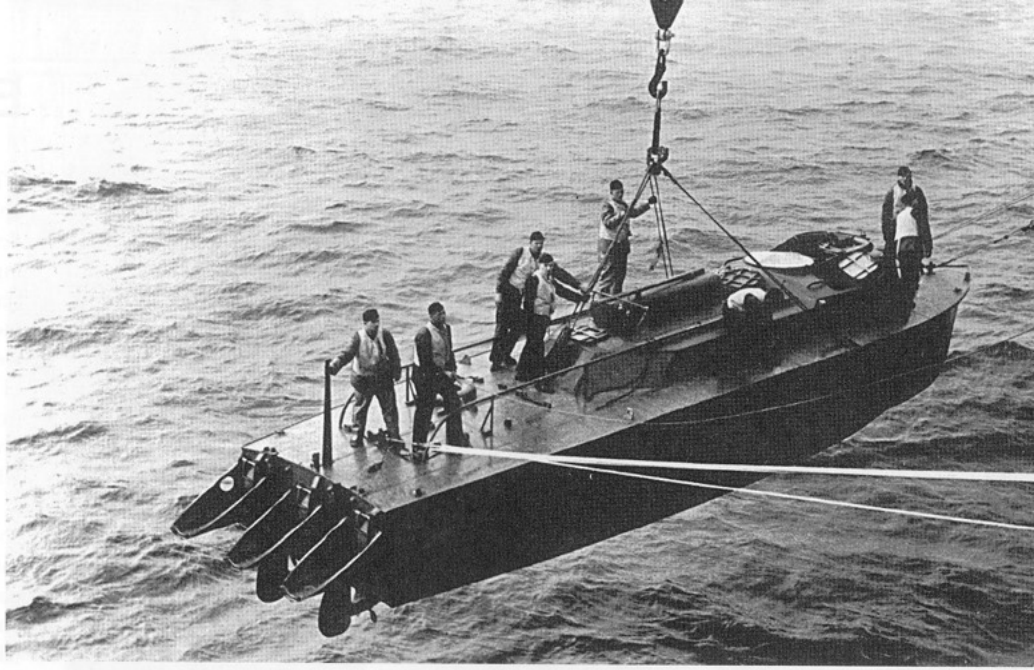
By the late 1930s, the *Kriegsmarine* developed the concept of a 'Midget' torpedo boat small enough for deployment from surface ships and *U-boote* (submarines). These boats would be clandestinely deployed within range of distant harbors, where they would either fire torpedoes or deposit mines and then escape. In 1938, work began on the **LS** (*Leichte-Schnellboot*; Light Speedboat) series, of which 34 boats were planned and 12 completed.

They were 12.5 M (41 feet) long, 3.46 M (11 feet 4.2 inches) wide, and 0.8 M (2 feet 7.5 inches) in draught. It displaced approximately 11.5 tons (10 MT), and was powered by two 850 HP Daimler-Benz MB 507 engines. It was designed to carry two rear launching 45 CM (17.7 inch) torpedo tubes or mines and a single 2 CM MG151/20 *Flak* in a Plexiglas domed, hydraulically operated Luftwaffe HD 151 turret over the wheelhouse. A nine-man crew operated the LS.

These boats were specially constructed from mahogany and light metal to save weight. The Naglo boatyard in Berlin constructed LS-1, while Dornier – specialists in seaplane construction – built the remaining 11 vessels at Friedrichshafen on the Bodensee (Lake Constance).

Delays in delivering the engines, turrets, and the special 45 CM torpedo tubes also meant that **LS-4** was the first boat actually to fit the original torpedo boat specifications. It was a success and could achieve 42.5 knots (49 MPH/79 KMH). The earlier boats were powered by troublesome 700 HP Junkers Jumo 205 aircraft engines, fitted out as minelayers, and armed with a 2 CM cannon in a simple Scarff ring. **LS-5** and **LS-6** also had Jumo 205 engines. **LS-2**, **LS-3**, and LS-4 were shipped aboard the auxiliary cruisers KOMET, KORMORAN, and MICHEL, respectively. (German auxiliary cruisers were armed merchant ships employed for commerce raiding during World War Two.) The remaining LS Class boats mainly served in the Aegean Sea, since they could be rail transported from northern Germany. Plans to stow LS boats aboard a submarine were never realized.

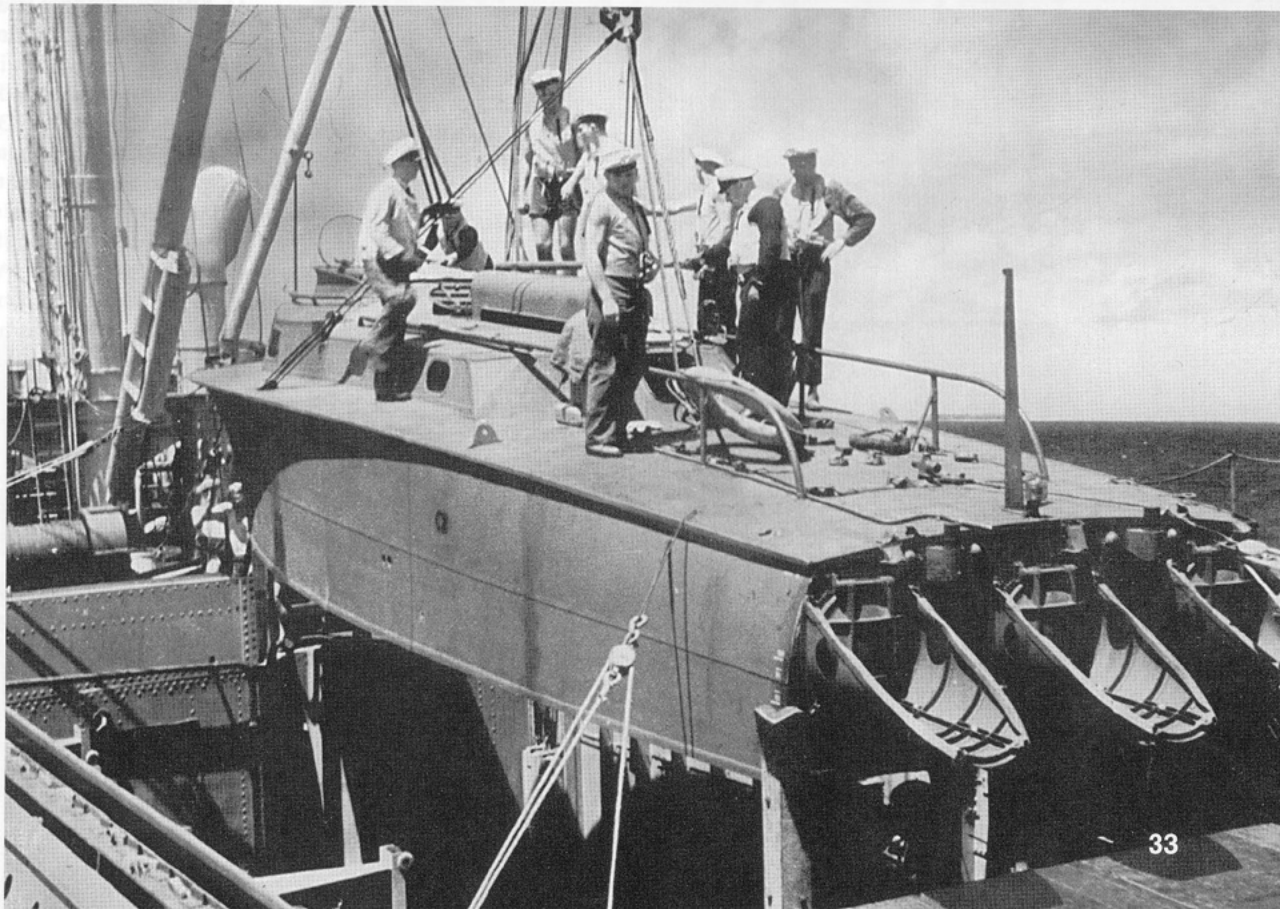


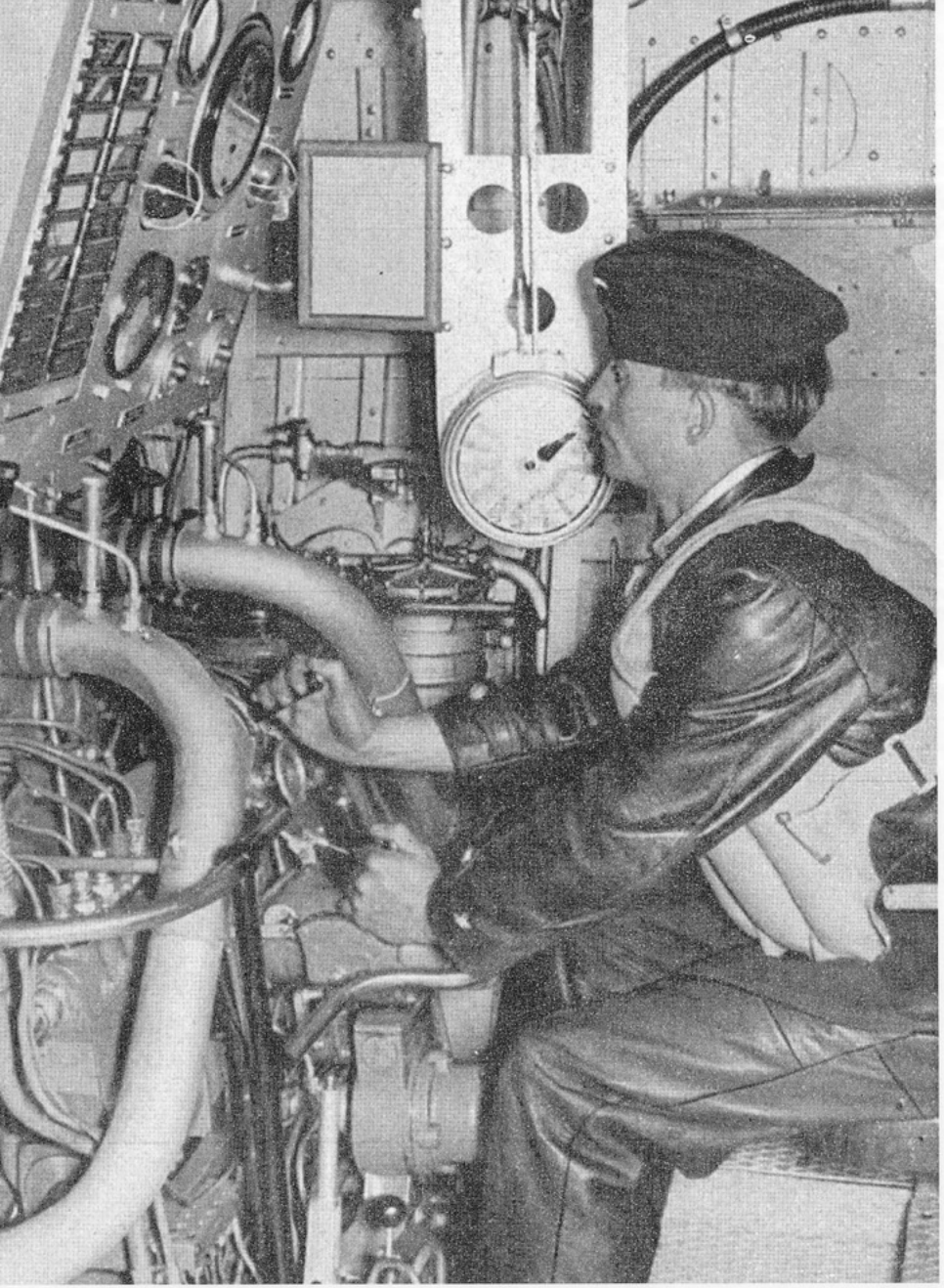


(Above) LS-2 is suspended on KOMET's derrick between missions. This vessel was appropriately nicknamed *Meteorit* (Meteorite). A circular spinning window designed to throw off seaspray or rain is mounted at the wheelhouse front. Handrails were mounted on the boat's superstructure. Two other *Leichte-Schnellboote* were assigned to auxiliary cruisers: LS-3 to KORMORAN and LS-4 to MICHEL. KOMET's Arado Ar 196 floatplane is directly behind LS-2. (Huff)

(Above Right) The eight man crew prepare *Meteorit* for a mission. The LS is lowered by crane from KOMET into the water. It was painted an overall dark gray color. LS-2's pair of 700 HP Junkers Jumo engines proved unreliable and the boat was scuttled in the Bismarck Archipelago, northeast of New Guinea. KOMET – formerly the merchant ship EMS – was sunk in the North Sea by the British Motor Torpedo Boat MTB-236 on 14 October 1942. (G. Huff)

(Right) *Meteorit* (LS-2) and its sisters were to have been armed with two 45 CM (17.7 inch) torpedo tubes. The unavailability of torpedo gear resulted in *Meteorit*'s equipment as a high-speed clandestine minelayer. Three TMB/S magnetic mines were deposited through chutes mounted in the stern. Several crewman stand on LS-2's aft deck while the boat is lifted by KOMET's crane. This vessel lacks the 2 CM *Flak* cannon mounted on other LS boats. (G. Huff)





**A *Schnellboot* motorman sits by one of the engines. His right hand is moving the throttle based on orders from the bridge, which were received on the telegraph to his right. These engine commands had to be immediately followed lest a collision occur. *S-boot* engines were sensitive to drastic control inputs and demanded a gentle hand on the throttle. The motorman wears a black leather protective suit and a life jacket. (H. Bürger)**

# Engines

The large, highly capable *Schnellboot* design was only possible through the development of a suitable powerplant. This engine was extremely powerful, compact, robust, and relatively lightweight. *Schnellboot* engines, like the boats themselves, underwent a constant evolutionary process, stressing individual quality and survivability over the production of large quantities of expendable materials. The boats were adapted to operate in increasingly harsh combat environments, requiring increases in engine performance to counter the growing weight of armor protection, anti-aircraft weaponry, and additional crewmen. Despite the increasing displacement of the boats, the top speed of the final *Schnellboot* versions exceeded the top speed of the pre-war boats, while fuel consumption remained nearly constant. The engine used in S-1 produced 900 HP; the final production type produced a Herculean 2500 HP. A 3000 HP engine for *S-boote* was in the final stages of development when Germany capitulated in 1945 and work had begun on a yet more powerful turbine engine.

The *Reichsmarine* commissioned M.A.N. and Daimler-Benz to build special lightweight high-speed diesel engines for the S-boot development program in the early 1930s. This was an important innovation in MTB design, because they reduced both fire risk and fuel consumption compared to gasoline engines. M.A.N. focused on an in-line design and Daimler-Benz on a more compact 'V' engine. Both firms used as a basis the powerful lightweight engine designs developed for Zeppelins (rigid dirigibles) during World War One.

M.A.N. was the first to deliver a production-ready engine. The L7 Zn 19/30, a seven-cylinder in-line double-acting two-stroke non-reversing engine was the first diesel engine available to the *Schnellboote*. It was first installed aboard the vessels S-6 to S-9. It produced a maximum of 1320 HP, but its weight exceeded specifications and was only able to propel the boats to a maximum speed of 32 knots (36.8 MPH/59.3 KMH).

The L7 Zn's shortcomings resulted in M.A.N. next producing the L11/Zu, a more powerful in-line, four-stroke engine with 11 cylinders producing a maximum 2050 HP. The engine was larger and heavier than the previous variant, which required increasing the dimensions of the *S-Boot* design. The result was the 97 ton (88 MT) S-14 Class. Capable of 37 knots (43 MPH/69 KMH), these boats met the speed requirements. Although exceeding the horsepower of the contemporary Daimler-Benz engine, the inline M.A.N. motors were big, heavy, and tended to suffer from mechanical problems. The long crankshaft was prone to damage through torsion. The tall motor casing had a high center of gravity, which stressed the motor mounts during maneuvers, eventually cracking them. Attempts to solve the problems, including strengthening the mounts, were unsatisfactory. M.A.N. attempted further variations, including a nine-cylinder version designated the L9 Zn 19/301 and a proposed 11-cylinder version.

Daimler-Benz developed a lighter, more compact diesel engine, the MB 502, at about the same time. The first variant produced a maximum of 1320 HP. It was a 16-cylinder V four-stroke engine. Although producing less power than its contemporary M.A.N. L7, its lighter weight, slightly lower fuel consumption, and the eventual addition of superchargers, which resulted in a 25 percent power increase, compensated this. Other advantages included excellent reliability and nearly invisible exhaust gases, unlike the dark exhaust produced by the M.A.N. engines.

The MB 502-powered S-10 to S-13 flawlessly performed in high speed endurance runs in the Baltic Sea, while M.A.N. engined boats proved unreliable and, on-average, slower than Daimler-Benz-equipped vessels. These trials convinced naval planners to decide against further use of M.A.N. engines in the *Schnellboote* and Daimler-Benz became the single supplier. This firm was already heavily taxed producing aircraft engines and ultimately engine shortages became a critical

bottleneck in *Schnellboot* production, despite exhaustive efforts by factory workers.

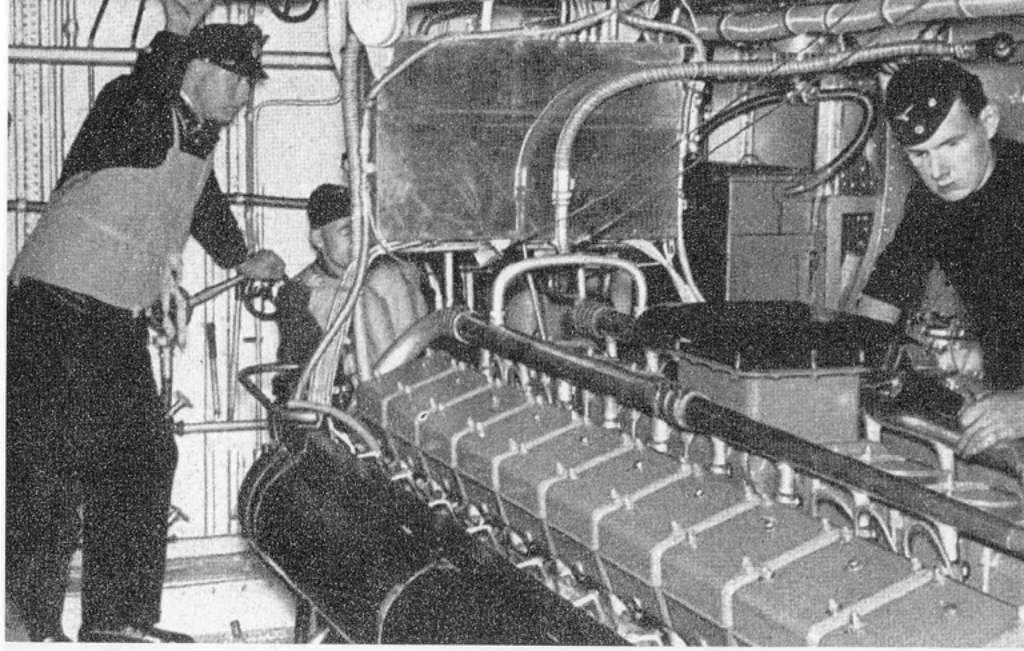
After the initial production run of MB 502 engines, Daimler-Benz immediately set about making an improved version, the MB 501. This was a 20 cylinder V engine which generated 2050 HP. Trials with this engine in S-18 through S-25 impressed the Naval Staff and they chose it as the standard *S-boot* power plant in 1938. The MB 501 proved highly dependable and a versatile basis for later improvements, such as the addition of a motor driven supercharger, which boosted output to 2500 HP. This supercharger became a standard fitting from S-139 onwards and the engine was redesignated MB 511. With a total output of 7500 HP, the MB 511 equipped the S-38 and S-100 classes, which when carrying 75 percent payload could make 43.5 knots (50 MPH/81 KMH) top speed.

The 3000 HP MB 518 was a final wartime attempt to increase engine output. It had the same dimensions as the MB 511, but weight was increased by two percent. Tests of this variant began in October of 1942 with highly satisfactory results. It could produce 3000 HP and up to 3300 HP under ideal conditions. Three MB 518 test engines were delivered to Lürssen and evaluated in S-170 in February of 1944. It achieved a top speed of 45 knots (52 MPH/83 KMH) while carrying four torpedoes, breaking the world record for the fastest MTB. Minor developmental problems coupled with heavy air raid damage to the factory led to the cancellation of the MB 518 series in favor of additional MB 511 engines.

The fuel capacity of the later *Schnellboote* was 17 tons (16 MT), but the average fuel load carried was 12 or 13 tons (11 or 12 MT) of diesel fuel. Exhaust was muffled by discharge from underwater vents. With a battle load, the later boats were capable of 42 knots (48 MPH/78 KMH). At 31 knots (36 MPH/57 KMH), they had an operational range of 600 miles (966 KM). The boats could maintain emergency flank speed for more than half an hour.

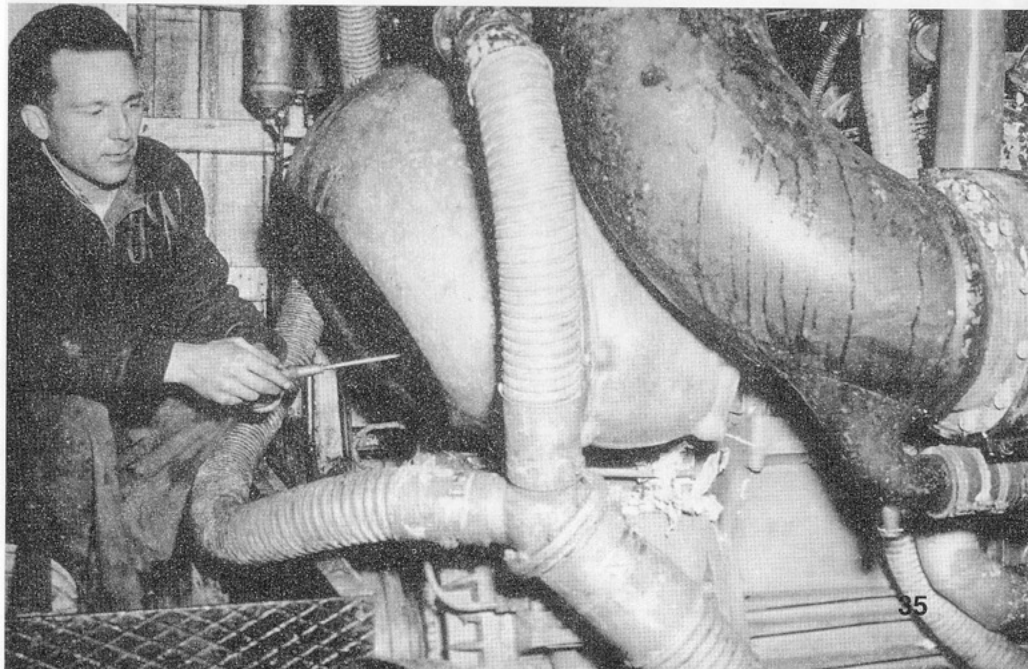
The two engine rooms reflected thorough German planning and smart design inherent in the entire *S-boot* program. They were spacious and well-ventilated, although noisy. Prior to the S-100 series, engine rooms were well illuminated by skylights. Conduits and wiring were neatly laid out to allow accessibility for quick identification and repair. The fire risk was greatly diminished by the use of diesel fuel and by a built-in Ardex fire extinguishing system. Modern instrument panels displayed performance of the three engines and instructions from the bridge were received on miniature engine room telegraphs. Although the engines were technological marvels, they required a delicate hand on the throttle and careful maintenance.

**The motormen's workplace was relatively spacious, well ventilated, well lit, and highly noisy. Communication while underway was chiefly by sign language. *Kriegsmarine* sailors preferred the dark blue side cap to the traditional 'Donald Duck' sailors' cap with black tally ribbon while at sea. (*"Die Kriegsmarine"* Photographer PK Böltz)**

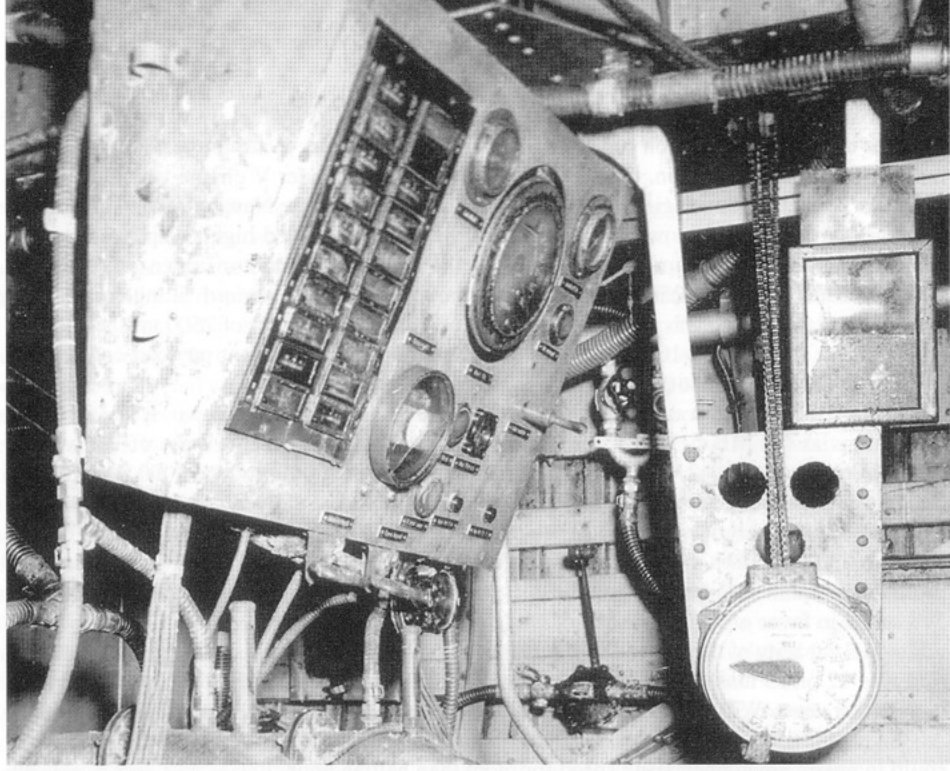


**The *S-boot*'s chief engineer (left, in peaked cap) and his men stand by their posts while the engine runs. These complex, high-power engines demanded constant attention and careful maintenance. Most *S-boote* had two engine rooms. (H. Bürger)**

**A US Navy technician examines the Daimler-Benz MB 501 engine's large ventilation conduits on a surrendered *S-boot* in 1945. The engines inhaled great amounts of fresh air, which entered the conduits via intakes mounted on deck. This powerplant also exhaled an equal amount of exhaust. (C. Marshall/US National Archives)**



A *Maschinistobermaat* (Machinist Chief Petty Officer; background) supervises a sailor while the latter services the MB 501 engine's fuel injector. Maintenance was often a matter of life or death and was emphasized aboard the Schnellboote. Major repairs were undertaken at shore bases or *S-boot* tenders, but crews had to perform routine maintenance themselves at sea. The sailor wears a gray work jacket, while the 'Chief' wears a navy blue pea jacket. (PK Warnke via D. Krakow)



Each MB 501 engine had an instrument panel for the motorman to monitor during engine operation. The telegraph to starboard relayed commands from the bridge, to which the motorman would acknowledge using the rim-mounted indicator. It was moved to match the needle position of the bridge command. (C. Marshall/US National Archives)

Engine exhausts were vented from the *S-boot* through large streamlined orifices located just below the waterline. The smaller orifice below the exhaust duct was the cooling water intake. This arrangement is on an S-100 Class vessel, but was common on most *Schnellboot* classes. (C. Marshall/US National Archives)

# Construction

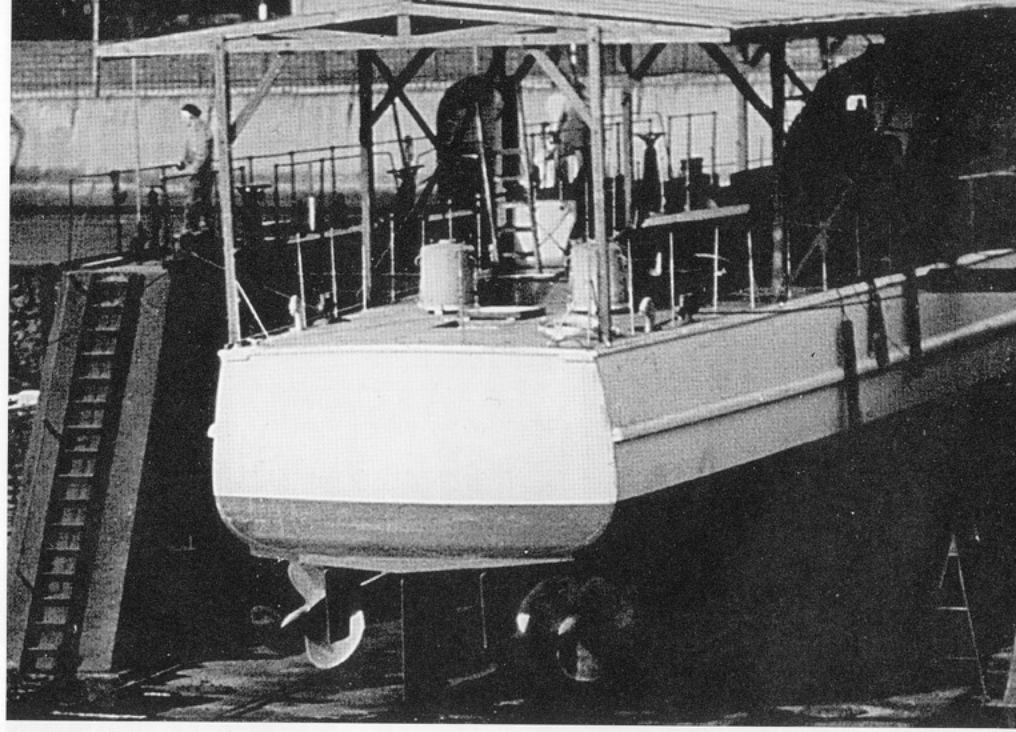
Large and robust, the wartime boats were built to withstand considerable wave buffeting, engine vibration, gun recoil, and battle damage. Boat construction took place primarily at the Lürssen boatyard in Vegesack, near Bremen. Numerous boats were also built by the Schlichtling yard in Travemünde, and several were built at the Gusto Werke in Schiedam, the Netherlands, and at Danziger Waggonfabrik in Danzig (now Gdansk, Poland). The size and complexity of these boats were a drawback to Germany's industrial base, because they demanded large numbers of skilled laborers and considerable material resources.

Construction of the S-38 and S-100 class hulls started with a keel made from heavy oak bolted together. The hull's longitudinals were made from either Oregon or Scotch pine. Around the engines, pine was replaced by oak. The aluminum alloy frames were spaced at intervals of 575MM (22.6 inches). The pine longitudinals were bolted to the frames, then diagonal stringers were riveted to the frames.

Bulkheads were designed to withstand flooding and light splinter damage. In order to save weight, those bulkheads at frames 18, 27, and 38 were 3MM thick steel plate from the keel to 30 CM above the waterline. Above this point they were 4MM thick. At frames 6, 11, and 15, the bulkheads were entirely 4MM aluminum-copper-magnesium alloy or light alloy. The collision bulkhead at frame 57 was made from 3MM galvanized steel. All bulkheads were stiffened with aluminum bracing. Seven bulkheads separated eight watertight compartments. The engine foundations were made of steel. Deck beams were made of 40MM (1.6 inch) by 35MM (1.4 inch) oak timbers, spaced 200MM (eight inches) apart and connected by longitudinal aluminum braces bolted to the frames. Planking was 23MM (one inch) by 23MM smoothly planed tongue-and-grooved Oregon pine or fir. This was covered with canvas and coated with a durable, waterproof synthetic resin paint. Removable plates over the engines facilitated removal for overhaul or replacement. Skin planking, which was double diagonal, comprised an inner layer of either white cedar or larch and an outer layer of mahogany separated by a layer of muslin. Light alloy was utilized for the bulwarks and the superstructure. Brass plating was applied 15 CM (six inches) on either side of the stem, around the exhaust ports, and on the stern.

The earlier, pre-war boats had thinner inner and outer planking, with the inner layer being nailed to the frames while the outer layer was riveted to the inner layer. From S-26 onwards, the outer layer was screwed to the inner layer as well as to the frames. After analyzing heavy damage sustained to S-17 through buffeting by heavy seas in September of 1939, stringers of light alloy were placed between the wooden longitudinals. Beginning with S-205, the builders added a third layer made necessary due to the additional load of heavier weapons and armor.

Although numerous *Schnellboote* were lost to collisions, this is more indicative of the pitch-black darkness and close quarters in which they fought rather than a design weakness. This is dramatically illustrated by an accidental ramming incident involving S-33 in the Skaggerrak between Denmark and Norway during the night of 9-10 May 1940. Lying in a fog bank after successfully attacking the British destroyer HMS KELLY, S-33 – commanded by *Oberleutnant zur See* (Lieutenant j.g.) Hans Schultze-Jena – was suddenly struck by the British destroyer HMS BULLDOG and then by KELLY, which BULLDOG was towing. A 9 M (29.5 foot) section of S-33's bow was torn away, flooding compartments VIII (8) and IX (9). The jolt was so severe that it caused the engines to stop, leaving the boat dead in the water approximately 60 M (197 feet) astern of the two destroyers. Whether by flooding or enemy fire, S-33 expected to sink immediately, but the number VII (7) bulkhead held fast. The engines sprang to life, pumps strained at full pressure to keep out the flood of water from numerous holes, and S-33 returned the 200 miles (322 KM) back to its base at Wilhelmshaven, Germany. A few weeks later, S-33 returned to battle and soldiered on until 1945, proving the structural integrity of the *Schnellboot* design.



**An S-100 Class boat is fitting out prior to commissioning at Lürssen's Vegesack boatyard. The stern wedge and small *'Effekt'* rudders are mounted on the stern of this dry-docked boat. Both *'Effekt'* rudders flank the main rudder and these control surfaces are immediately aft of the propellers. Two cylindrical smoke generators are fitted to the afterdeck. (PT Boats, Inc.)**

**The US Naval Intelligence Mission in Europe examined a raised *S-boot* salvaged from the harbor basin at Le Havre, France in April of 1945. Their notes on the boat's construction materials are written on the photograph they took. This captured vessel was never identified with a hull number; instead, the US Navy designated it Captured Enemy Equipment 6527. (C. Marshall/US National Archives)**

**A flotilla tender lowers a torpedo onto an S-26 Class *Schnellboot* in Norway. Reload rails were mounted aft of each torpedo tube along the boat's sides. A tarpaulin covers the aft torpedo tube door. *S-boote* normally carried two torpedoes in their tubes and two reserve weapons aft of the tubes. A cylindrical forced air ventilator common to this *S-boot* class is mounted amidships. (H. Bürger)**

# Main Armament

Thomas Whitehead's 1866 invention of the torpedo brought about a revolution in naval warfare. The first examples were short ranged and ponderously slow, but the implications were great: the torpedo could enable a small craft to destroy a much larger one, or a small navy to threaten a great navy. Uniquely, it could also be aimed and fired underwater. In the naval arms race that preceded World War One, the potential of such a device was appreciated by German naval engineers seeking ways to undermine the British Royal Navy's global domination. The German *U-Boot* fleet, while not securing a victory for Germany in the 1914-18 war, proved beyond any doubt the effectiveness of Whitehead's invention.

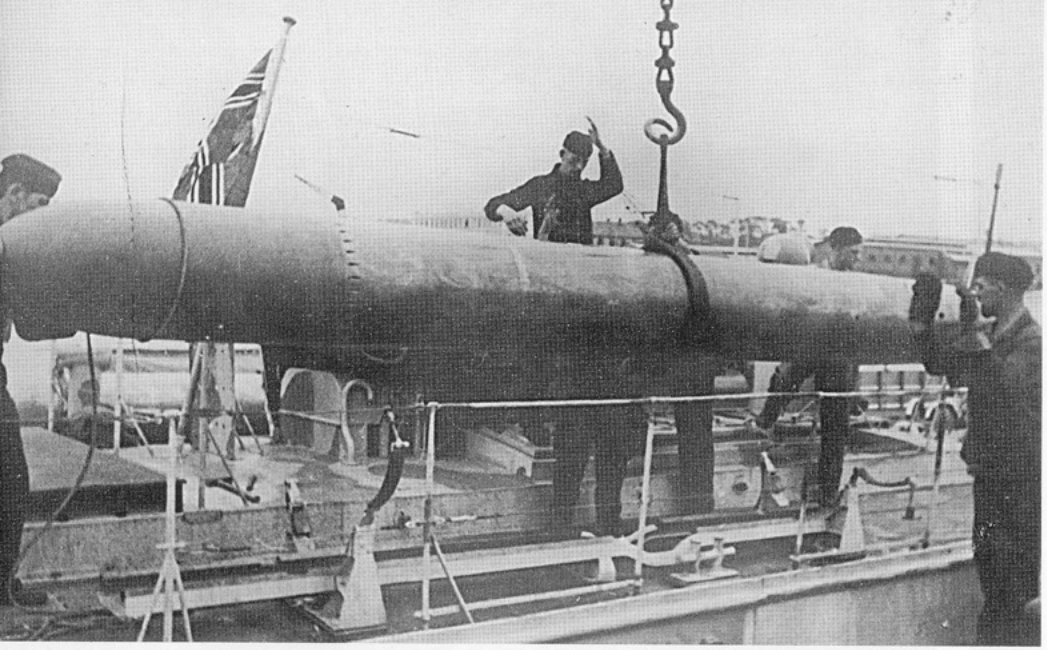
In the 1920s, the German naval command once again found itself in the position of a weak force anticipating battle with a much stronger one. The torpedo presented a viable solution. Using the considerable experience gained during World War One, the Germans began working on improved torpedoes and creating vessels such as the *S-boote* and *U-boote* to deliver them stealthily and escape to fight again.

The *Schnellboot*'s 'main battery' consisted of two 53.3 CM (21 inch) torpedo tubes mounted on the bow. *S-boote* typically went to action with one torpedo in each tube. Cradles for up to four extra torpedoes were mounted on the deck of later classes; however, two was the normal reserve load. Reserve torpedoes were less frequently carried in areas such as the English Channel, where the Allies employed effective countermeasures. Their weight adversely affected performance, especially of boats with the armored *Kalotte* (Skull Cap armored bridge dome), and the hit-and-run tactics rarely allowed the five minutes it took a well-trained crew to reload a tube.

The G7a torpedo was the standard German torpedo of World War Two. It was designed for use by both submarines and surface ships and entered service in 1938. It was 7.16 M (23.5 feet) long and 53.3 CM in diameter. The G7a weighed 1528 KG (3369 pounds), including a 320 KG (706 pound) Hexanite warhead. Range was 5000 M (5468 yards) at 44 knots (51 MPH/82 KMH), 7500 M (8202 yards) at 40 knots (46 MPH/74 KMH), and 12,500 M (13,670 yards) at 30 knots (35 MPH/56 KMH). The fuel was Dechaydronaphthalene (alcohol) mixed with compressed air and burned to develop steam for a turbine, which spun two counter- rotating propellers. The 44-knot speed was found to overload the engine and was not used until the problem could be resolved later in the war. The torpedo's course could be preset for any angle up to 90° from launch. In a parallel to the severe problems experienced by the wartime US Navy, the German torpedoes suffered from unreliable detonators, and no adequate solution to this problem was found until late 1942.

Beginning in June of 1944, *S-boote* deployed the electric T3d *'Dackel'* (Dachshund) against the Allied supply ships off Normandy with occasional success. This was an extremely long-range torpedo that could be set to make a straight run into a harbor and then to travel in a pattern until either striking something or running out of power. The T3d, with its energy-conserving nine-knot (10 MPH/17 KMH) speed, could be launched at a range of up to 57,000 M (62,336 yards) – safely beyond the Allies' strong defensive line around the Normandy beachhead. This torpedo was 11 M (36 feet) long and weighed 2216 KG (4885 pounds). Its warhead was comparatively light at 281 KG (620 pounds).

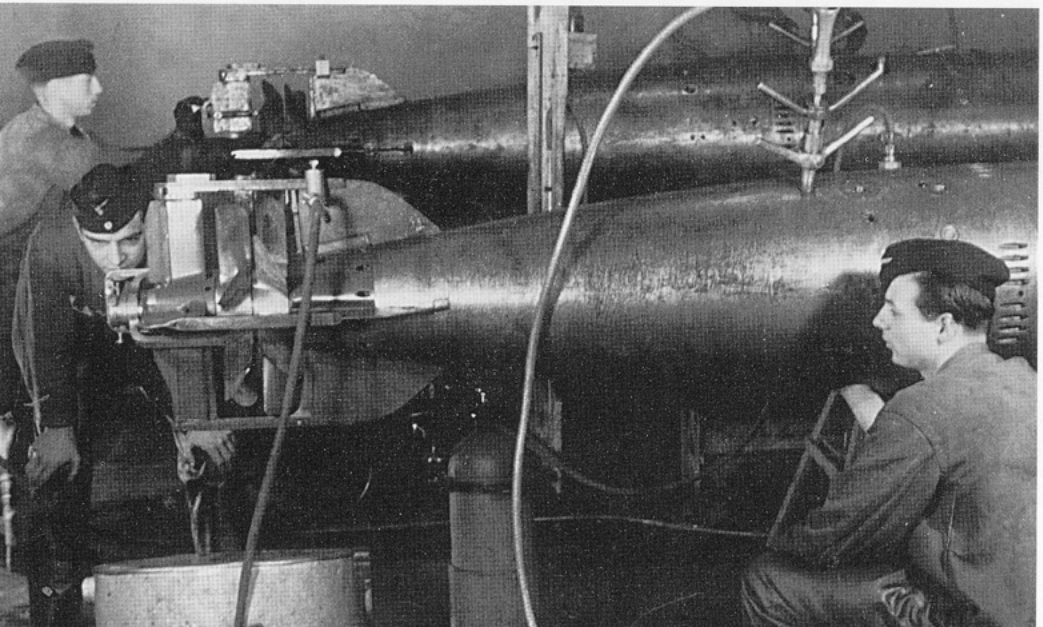
Also in the Normandy area in mid-1944, the *S-boote* were armed with the T5a *'Zaunkönig'* (Hedge Sparrow), a fairly effective acoustic homing torpedo. The T5 series of torpedoes was electrically powered and entered service on *U-boote* in 1943. The T5 was 7.2 M (23.6 feet) long, weighed 1497 KG (3300 pounds), and had a 200 KG (440 pound) Hexanite warhead. The

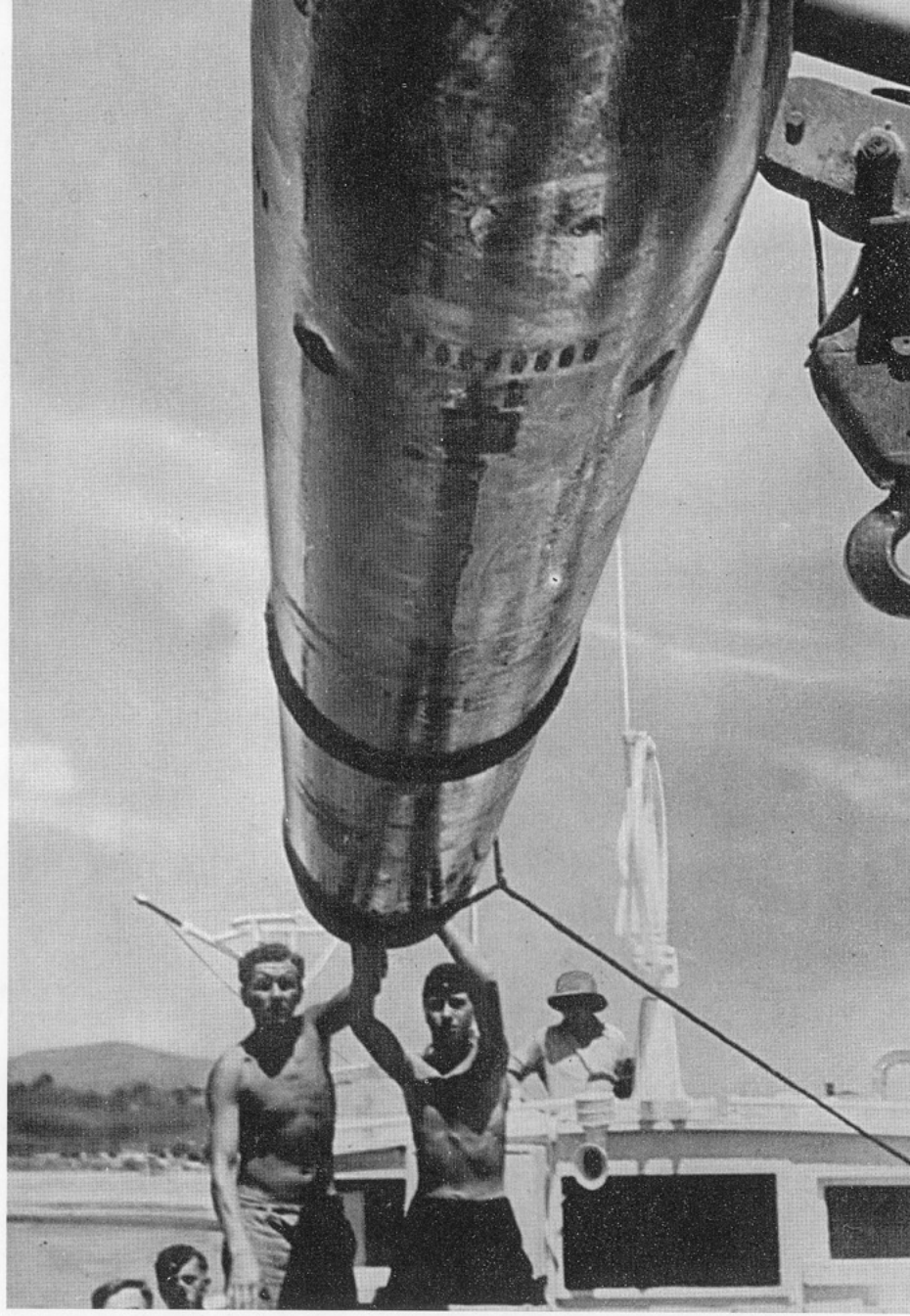


**Crewmen aboard this S-38 Class boat gently lower a reserve torpedo onto its deck-edge cradle. This vessel is equipped with an intermediate type of fixed cradle, which was further simplified on the later S-100 Class. The earliest cradle designs enabled the torpedo to be stowed flush against the deckhouses, which provided increased deck access. (D. Krakow)**

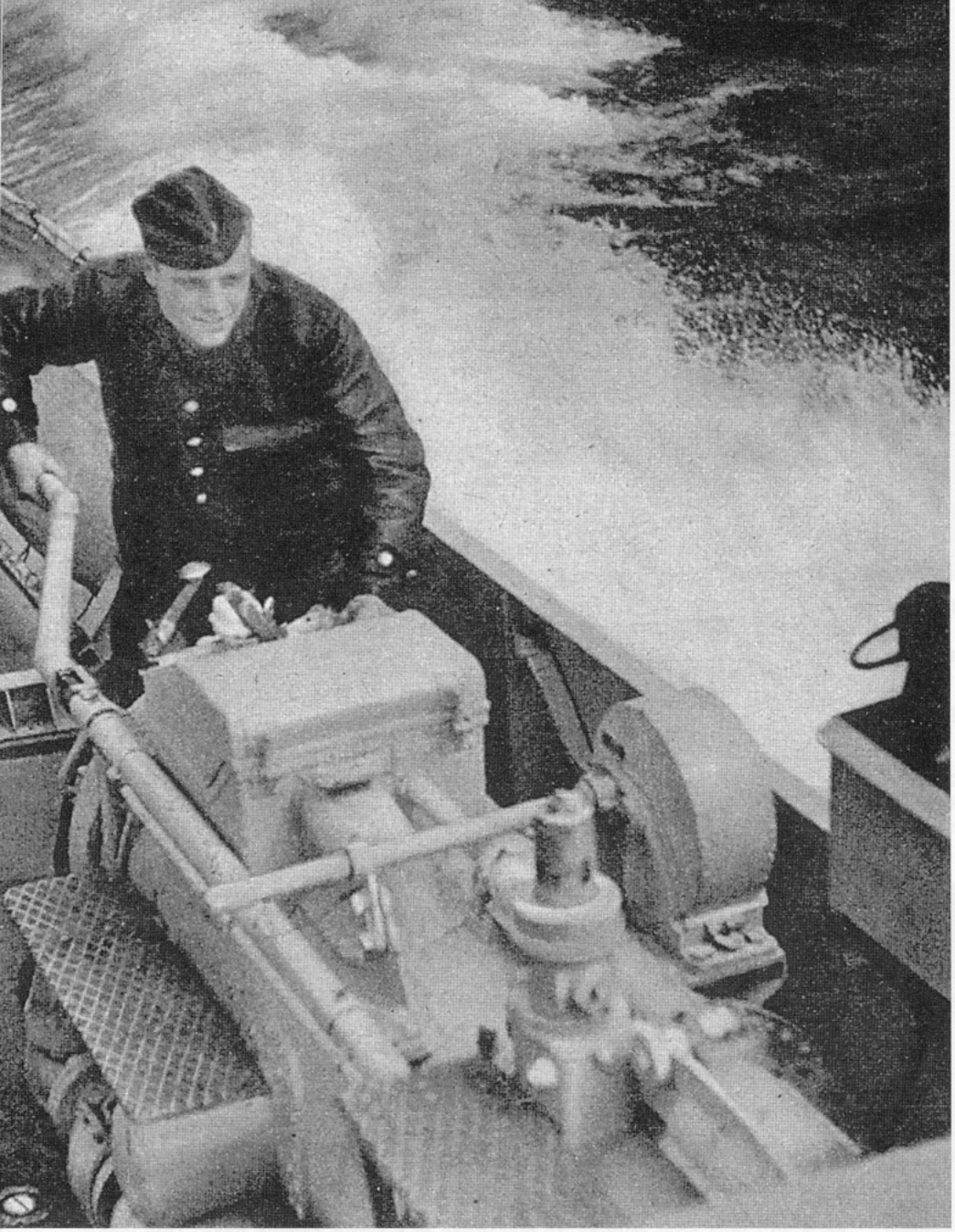
T5a was modified for *S-boot* use and had an 8000 M (8749 yard) range at 22 knots (25 MPH/41 KMH). Lead-acid batteries provided power.

**Three *Torpedomechanikeren* (Torpedo Engineers) perform routine maintenance on two 'fish' intended for *S-boot* use. Torpedo reliability was always a critical issue and much of it depended on constant maintenance. Contra-rotating propellers within the tail unit provided thrust for the torpedo. (PT Boats, Inc.)**

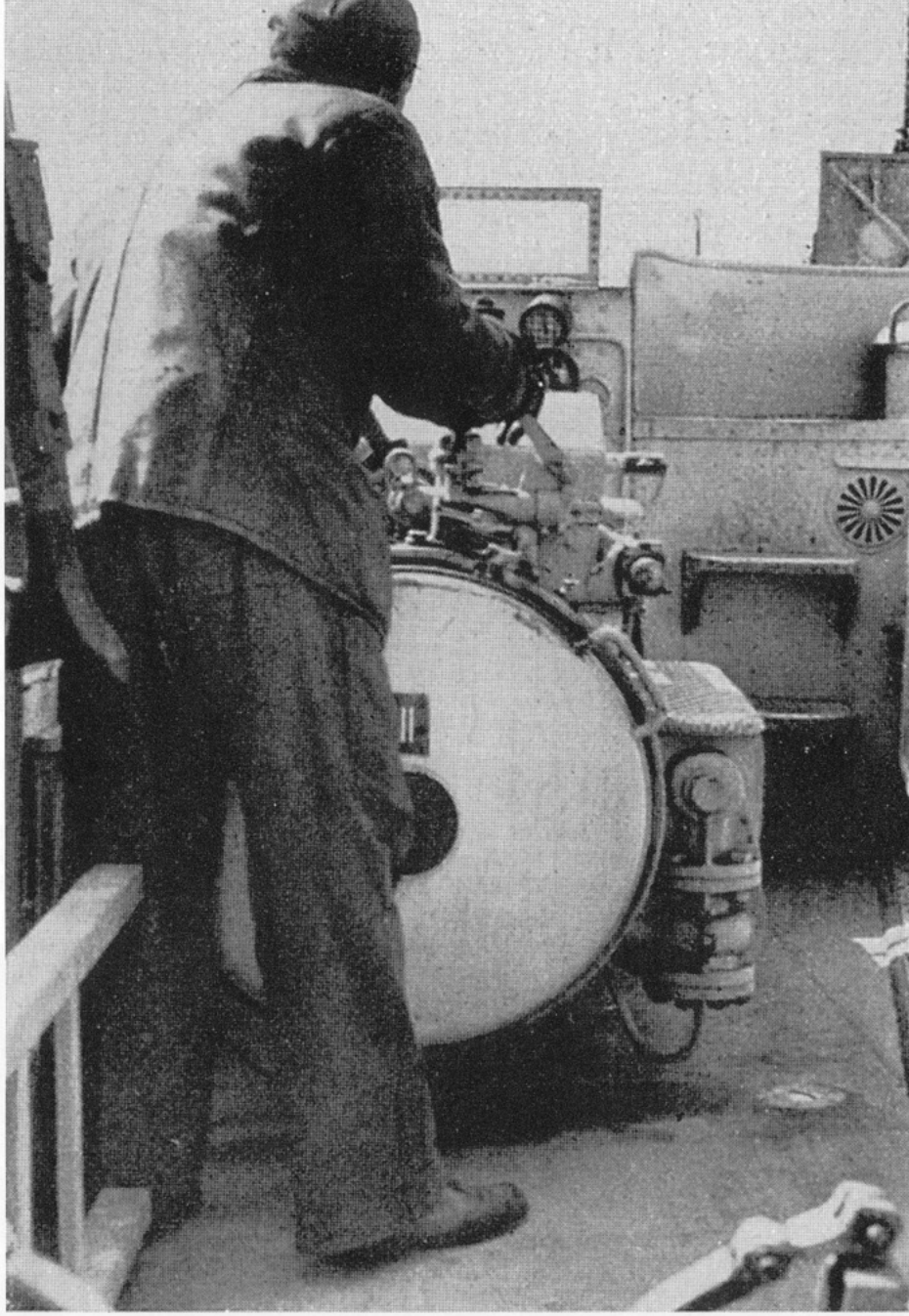




**An S-30 Class boat reloads its torpedoes at a North African base. This was always a delicate operation, due to the torpedo's fragile gyroscopic guidance mechanism. This mechanism was located in the torpedo's after body and steered the weapon through the tailfins surrounding the propellers. (*"Die Wehrmacht"* Photographer PK Pietzsch)**

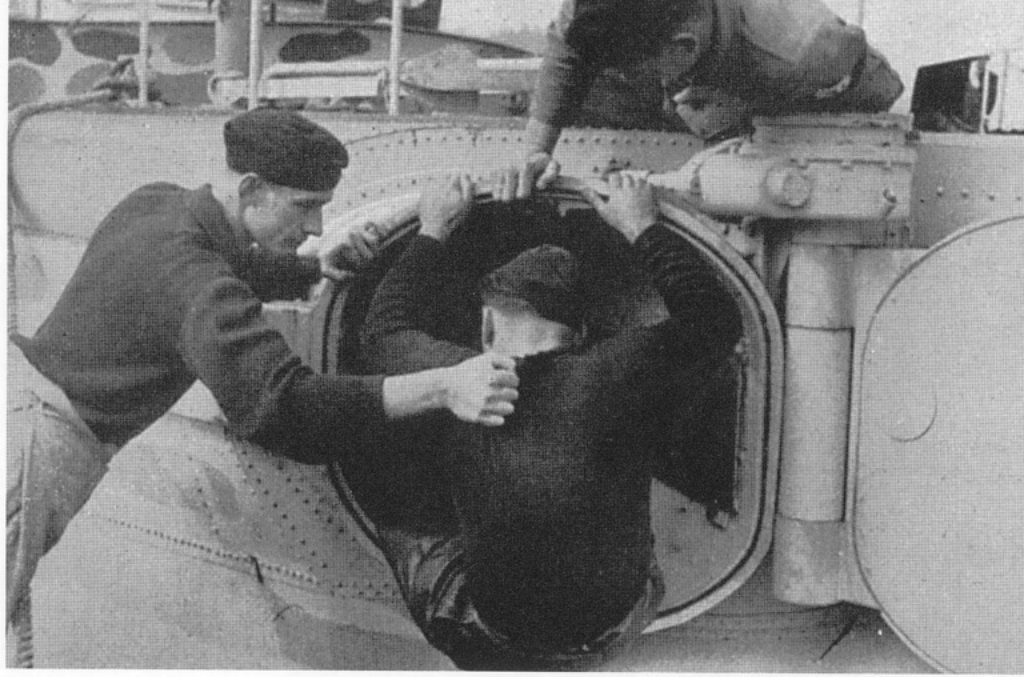


A torpedoman stands at his battle station aft of the Number Two (port) tube. He is turning the bow torpedo door operating handle, which opens the door when enemy contact is expected. This door is normally kept shut while the *S-boot* is underway to keep seawater out of the tube. (PK Waske via D. Krakow)



This torpedoman awaits the firing order at the Number Two (port) tube. His right hand rests on the plunger that fires compressed air from the tank mounted to starboard. Compressed air forced the torpedo out of the tube and into the water, with its engine started. (Bürger)

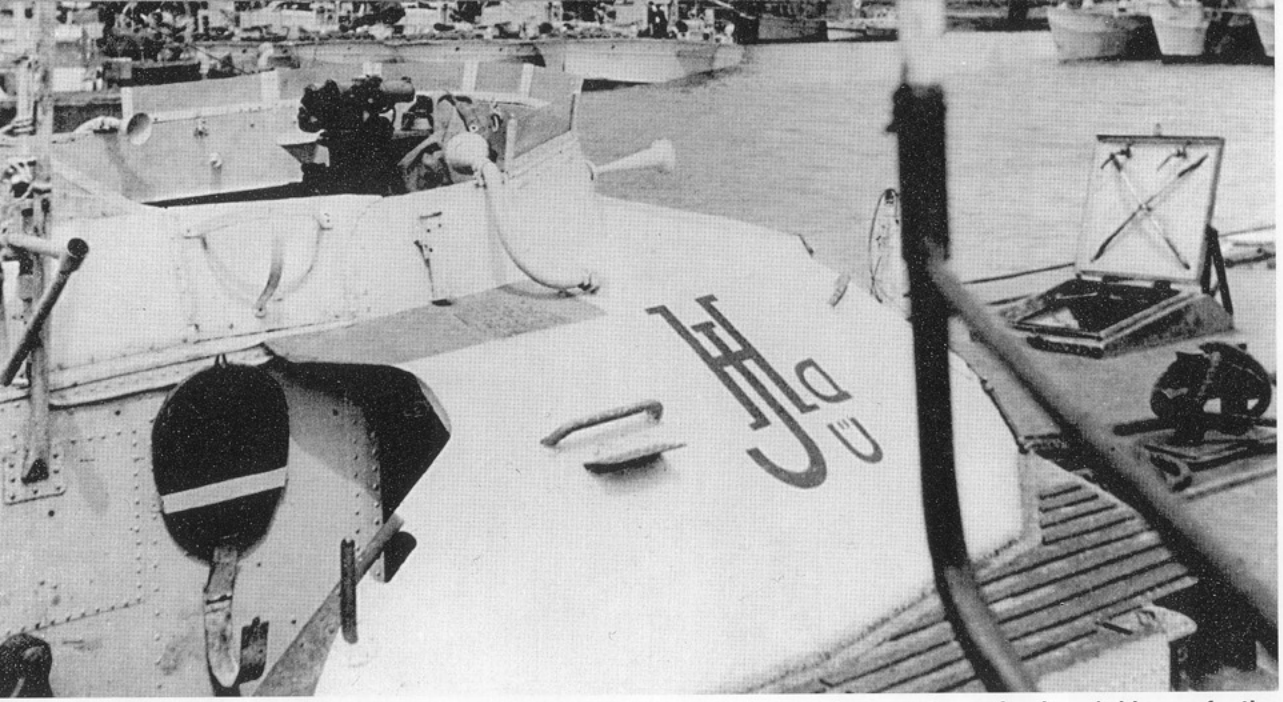
**A US Navy sailor examines the port torpedo tube of a raised *S-boot*, whose bridge was blown away by its crew during scuttling. The aft torpedo tube door was hinged outboard and sealed by rotation. The door sealing crank fitted into the rotating gear at the tube opening's 11 o'clock position. Ammunition boxes for 7.92MM MG34 machine guns were stowed on the forward bulkhead rack, immediately to starboard of the tube. (C. Marshall/US National Archives)**



**Immediately before getting underway, a torpedoman climbs into the starboard tube to insert a detonator into the torpedo's warhead. A small propeller attached to the detonator spun as the torpedo sped through the water. This propeller served as a timer to arm the weapon after it had traveled approximately 30 M (98.4 feet) from the *S-boot*. In icy weather, the tube shutters required extra waterproofing so the torpedoes would not be trapped by ice. (H. Bürger)**

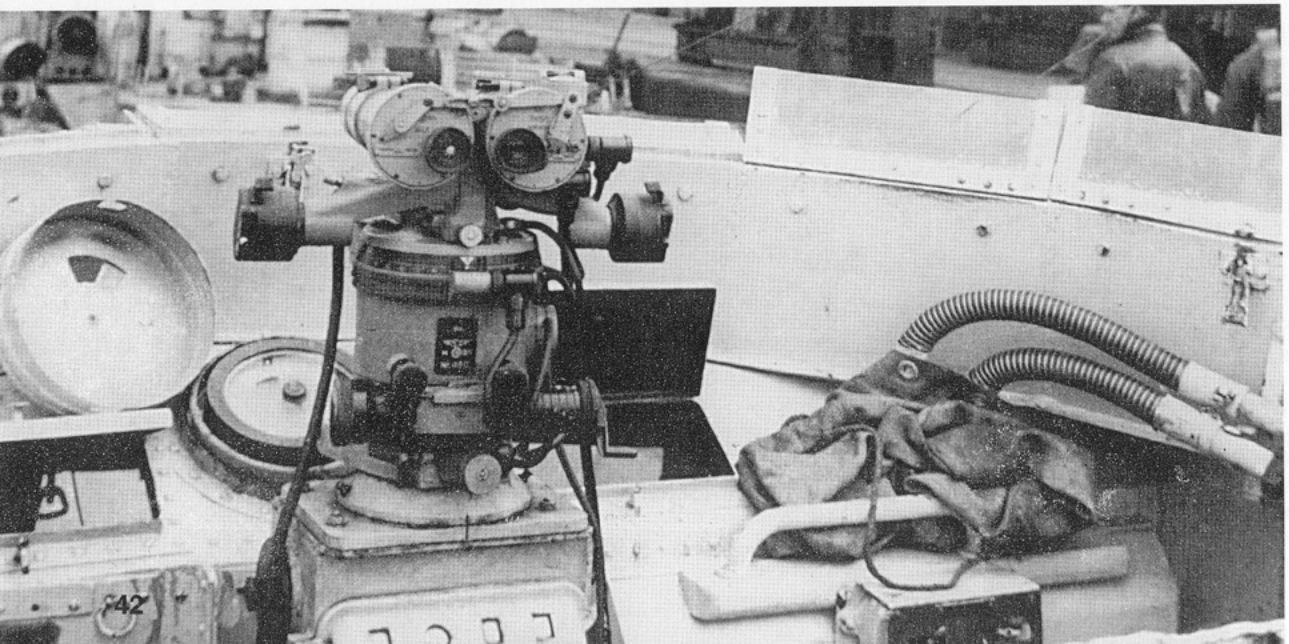
An optical torpedo director was mounted on a column in the bridge on the centerline. S-20 to S-29 were fitted with a torpedo director designated RZA3, which did not allow for angled attacks. All boats after S-30 were fitted with the improved RZA5, which had a mechanical analogue attack computer to facilitate angled attacks. Heading was entered automatically by aiming the binoculars at the target. Speed and range were entered using hand wheels. Once this data was entered, a firing solution was calculated and settings were automatically relayed to the torpedoes in their tubes.

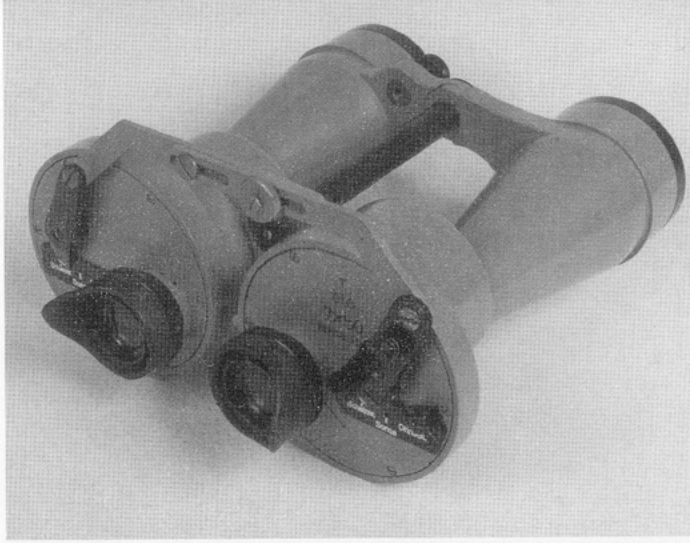
**In a scene familiar to torpedo boat crews of all navies, the bridge crew of this S-38 Class boat keeps a sharp watch for potential targets. Four of the crewmen are using binoculars to peer into the distance. All are wearing the standard *Wehrmacht* (German Armed Forces) M35 *Stahlhelm* (steel helmet), which was issued in a dark green color to the *Kriegsmarine*, but sometimes painted gray by crewmen. This helmet offered protection from projectiles and shrapnel to crewmen exposed on the bridge and deck. (PT Boats, Inc.)**



The RZA5 torpedo targeting director is mounted at the center of the bridge of the S-100 Class boat Ha-Jü. A dark round ventilator cover hangs on the bridge side, immediately above a life ring holder. This *S-boot* was field modified to include additional voice pipes to below decks positions and a helmet rack. A machine gun pintle and an oval hand grip are located on the *Kalotte*'s starboard aft edge. (J. Lambert)

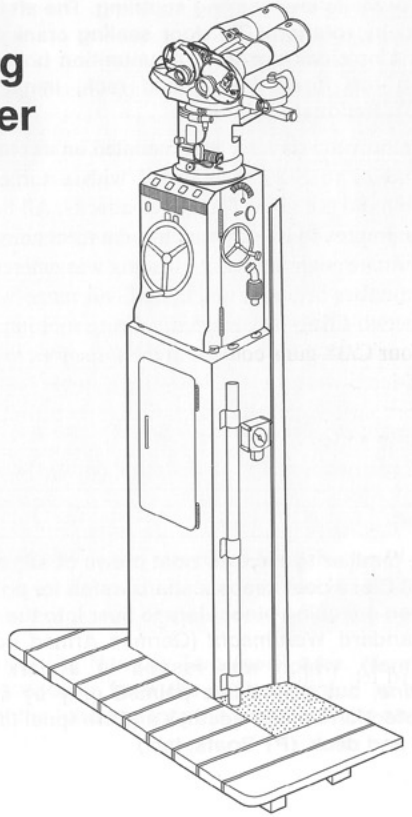
The RZA5 torpedo targeting director is located directly aft of the bridge compass. Flexible voice tubes enabled direct communication to various points throughout the boat. The two rectangular ports provided communication with the wheelhouse crew. (J. Lambert)





These Zeiss 7x50 binoculars were mounted onto the torpedo tar geting computer. It was also used by the *S-boot*'s *Kommandan* and lookouts while scanning the horizon. This set of precision optics was robust for sea duty and optimal for night use. (Dr. S Rohan Collection)

## RZA5 Targeting Computer



# Secondary Armament

The *Schnellboote* were forced to deal with increasingly strong Allied countermeasures as World War Two progressed. These included growing Allied air superiority and British gunboats built specially to combat the German 'E-Boats'. In addition to armor plate introduced with the S-38 class, firepower increased as per *Schnellboot* fleet commander *Fregattenkapitän* (Commander) Rudolf Petersen's observation: *"In Schnellboot battles, the maximum amount of iron should be fired at the enemy as quickly as possible."*

For close defense, covering boarding parties, etc., early boats carried one or two World War One vintage 7.92MM Bergmann MG15 water-cooled machine guns. These were later upgraded with the standard 7.92MM Mauser MG34 light machine gun. Several MG34s were carried in the boat's weapon's locker and could be mounted on pivots positioned on the bow and around the bridge. Photos indicate that crews would obtain additional light machine guns whenever possible in order to meet increasing threats from the air. Many guns were Luftwaffe types, apparently salvaged from wrecked aircraft.

Many S-38b class boats were fitted with the *Zwillingsockel* (Twin Pedestal) 36, which mounted two MG34 machine guns in a light, manually-operated anti-aircraft turret. Its advantages were its small size, enabling it to fit between the large ventilator trunks amidships above the engine room, its light weight, and its crew requirement of only one or two.

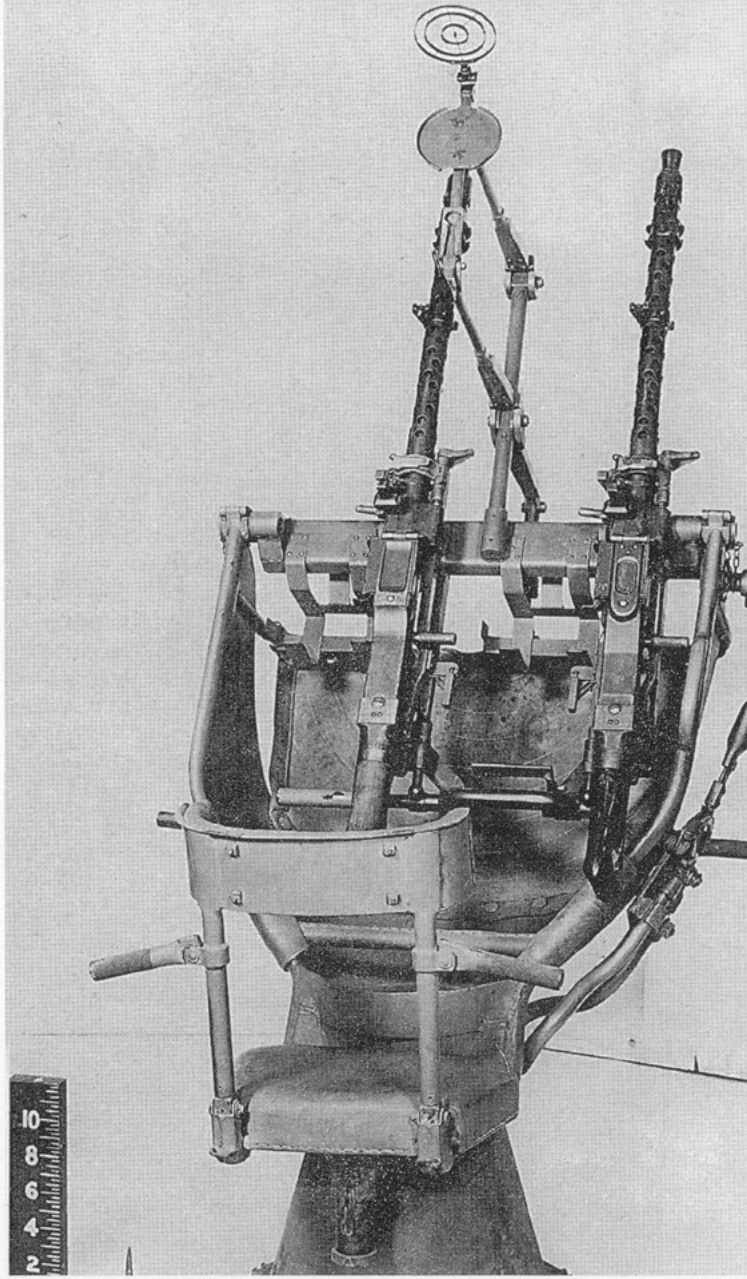
At the outset of World War Two, the *S-boote* mounted a single 2 CM Rheinmetall MG C/30 cannon on a platform on the afterdeck for anti-aircraft defense. With a 20-round magazine, its cyclic rate of fire of 280 rounds per minute was hampered by frequent magazine changes, rendering its actual rate of fire closer to 120 rounds per minute. Its maximum range was approximately 4900 M (16,076 feet) horizontally or 3700 M (12,139 feet) vertically. In 1941, the improved C/38 model superseded this design, which showed a tendency to jam. Both guns were mounted on a pedestal designated L/30. The combination of the gun and mount weighed approximately 420 KG (926 pounds). This single mounting was manually operated and could be elevated to 85° and depressed to 11° below the horizontal.

Beginning with boats in S-38 class, an additional 2 CM C/38 gun was mounted in the bow. The position gave the gunner a good field of fire and some protection. Early versions were mounted on a simple Scarff ring that was not well-suited for firing at aircraft. An improved design, the *Drehkranzlafette* 41 could deliver fire in a hemispherical arc, from 0 to 85° of elevation and with full 360° traverse. It had a pantograph gun sight that enabled the gunner to fire upwards at aircraft without crouching. All versions of the gun could be stowed internally. For stowage, the barrel of the 2 cm gun was detached, and the gun mount swung downwards into the tub on a hinge. A cover fitted over the turret, protecting it from rain and spray. Earliest versions had rectangular sliding doors. Later versions had a round cover that was manually fixed in place.

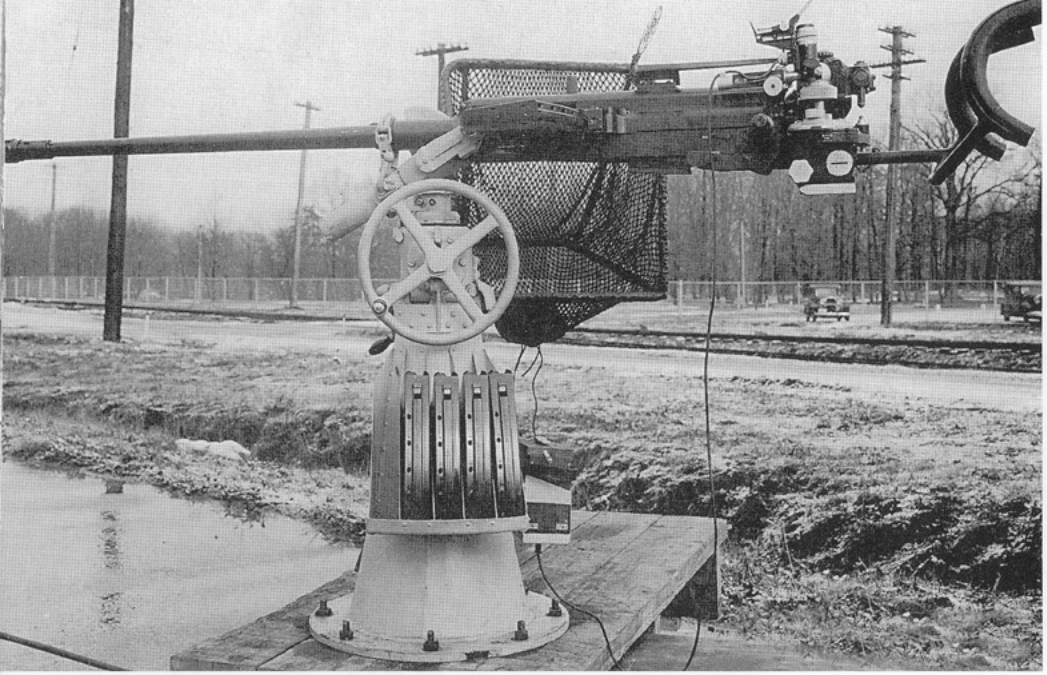
A small number of boats, including S-65, were field-equipped with the four-barreled 2 CM *'Flakvierling'* around 1944. Each of the two firing pedals operated a pair of guns, each upper gun being coupled with the lower gun on the opposite side. The four C/38 guns could deliver a theoretical cyclic rate of fire of over 1600 rounds per minute with all barrels firing. In practice, it was preferable to fire a single pair while the other pair was reloaded. The weapon had tremendous psychological impact, especially when firing tracer, but was impractical for *Schnellboot* use due to the 7-8 man crew needed to service it in action.

Also beginning with the S-38 class and continuing into the S-100 class, numerous boats carried the 4 CM Bofors Flak 28 cannon on the afterdeck. It was the same license-built Swedish design as manufactured by the Allies. This weapon was sometimes fitted with armored shields for protection against light projectiles and shrapnel. The gun weighed approximately 521 KG (1149 pounds) and had a rate of fire of 128 rounds per minute. Its maximum range was 10,000 M (32,808 feet). It could be fired in either semi-automatic or automatic mode, using a foot pedal trigger. While the 4 CM Bofors was a reliable and effective weapon against air and sea targets, its chief drawback was the requirement for a seven-man gun crew.

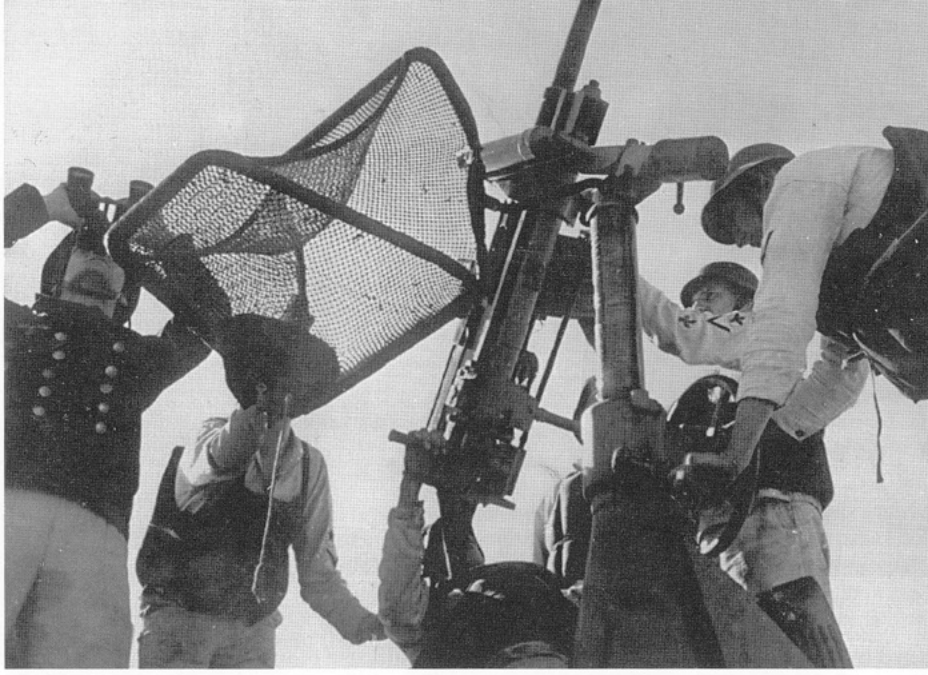
The S-100 class sought to overcome this problem with a fully automatic quick-firing 3.7 CM *Flak* turret specially designed for shipboard use against attacking aircraft. Designated the 3.7 CM *Flak* LM/42, it was a shielded weapon that could be fully operated by only three or four men. With a properly trained loader feeding the five-round ammunition clips, it could maintain uninterrupted fire of 190 rounds per minute. It entered service in 1943 and had a 6400 M (20,997 foot) range at




**The *Zwillingsockel* (Twin Pedestal) 36 turret mounted two 7.92MM Mauser MG34 machine guns. This was a common light Anti-Aircraft (AA) turret fitted to the S-38 and S-38b Classes. The MG34 had a muzzle velocity of 755 M (2477 feet) per second, a cyclic firing rate of 800 to 900 rounds per minute and a maximum horizontal range of 4570 M (4998 yards). (US Army Ordnance Museum, Aberdeen)**



**A 2 CM Rheinmetall MG C/38 cannon is displayed on its pedestal. This unshielded, manually operated single mount was the *Kriegsmarine*'s standard light AA gun. The gunner rested the C-shaped supports on his shoulders when aiming and firing. Four 20 round magazines are stored on the pedestal's side. The C/38 had a full cyclic rate of fire of 280 rounds per minute, which was reduced to 120 due to frequent magazine changes. (US Army Ordnance Museum)**



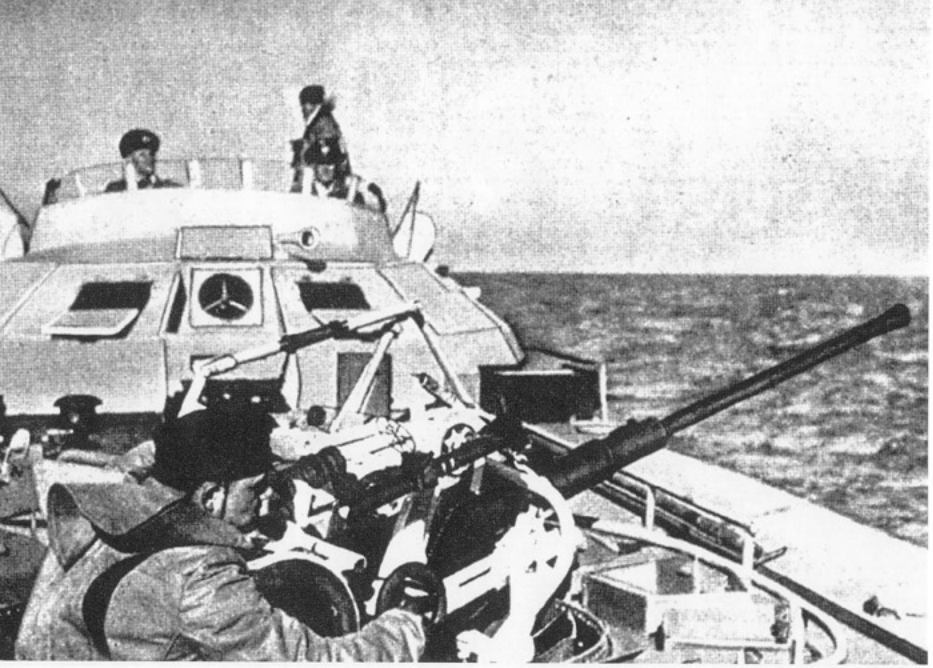
**An *S-boot*'s 2 CM C/38 crew takes aim at enemy aircraft. The optional basket clipped to the weapon held spent shells for safety. One sailor uses binoculars to search for targets while another assists the spotter. A sailor loads an ammunition magazine into the gun which he received from a colleague standing beside the gun pedestal. (PK Steinmetz via D. Krakow)**

45° and an anti-aircraft ceiling of 4800 M (15,748 feet). Its arc of fire was -10 to +90° in the vertical plane and the mount had a 360° traverse. The mount including the armored shield weighed approximately 1350 KG (2976 pounds).

Other defensive armament included up to eight depth charges. When lashed to small floats that delayed their rate of descent, these could be used to discourage pursuit. Two large smoke generators were used for escape and evasion. Each was capable of delivering a thick cloud of gray smoke for up to half an hour. Smoke buoys of both German and French manufacture were stowed in ready positions on the aft deckhouses of the S-100 class. They could be dropped overboard to establish a static smoke screen or to mark a position. Other munitions included hand grenades for boarding parties and signal flares which were stowed in a box just aft of the bridge cockpit.

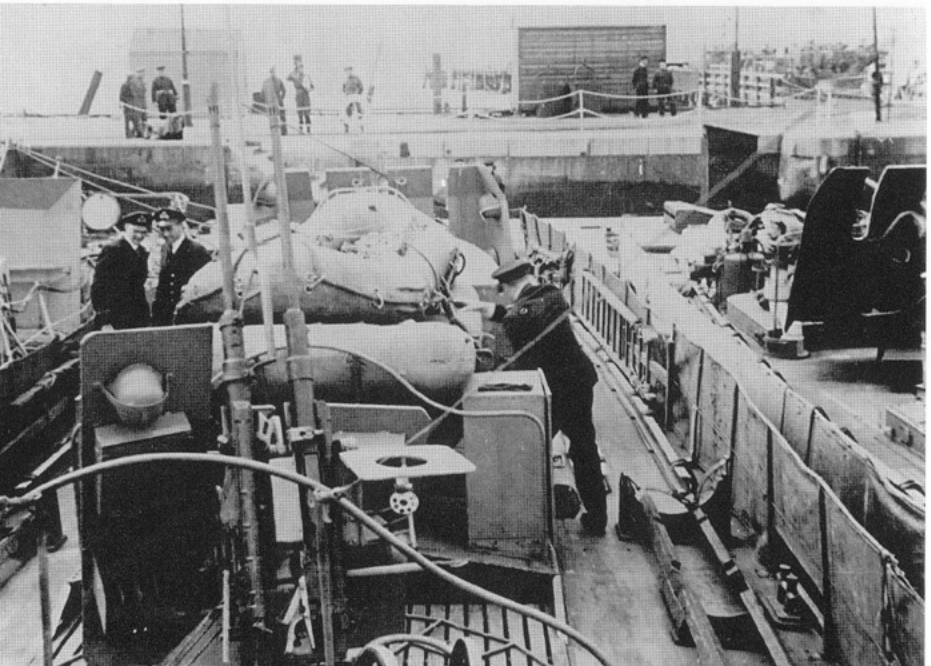
The *Kriegsmarine* deployed *S-boote* as clandestine high-speed minelayers as early as 1940 as a result of pre-war experiments with S-14, S-15, and S-16. Removable mine rails were fixed port and starboard for roll-off ground mines. Various types were deployed on the *S-boote* including the EMC, UMA, UMB, Spr BD, RB, and later the captured Soviet M08. As the war progressed, they carried more sophisticated types, including the tube-deployed TMA type mines. These were influence mines and tripped by either acoustic or magnetic signals. An out growth of the tube-launched mines developed for *U-Boote*, they were particularly effective and accounted for the majority of kills achieved by *Schnellboot* mine laying operations.

**The bow 2 CM gun was crewed by a gunner and loader. Ammunition stored below decks was passed through a hatch in the rear of the gun tub. A pantographic sight allowed the gunner to accurately aim his weapon. (PK Langegger via D. Krakow)**

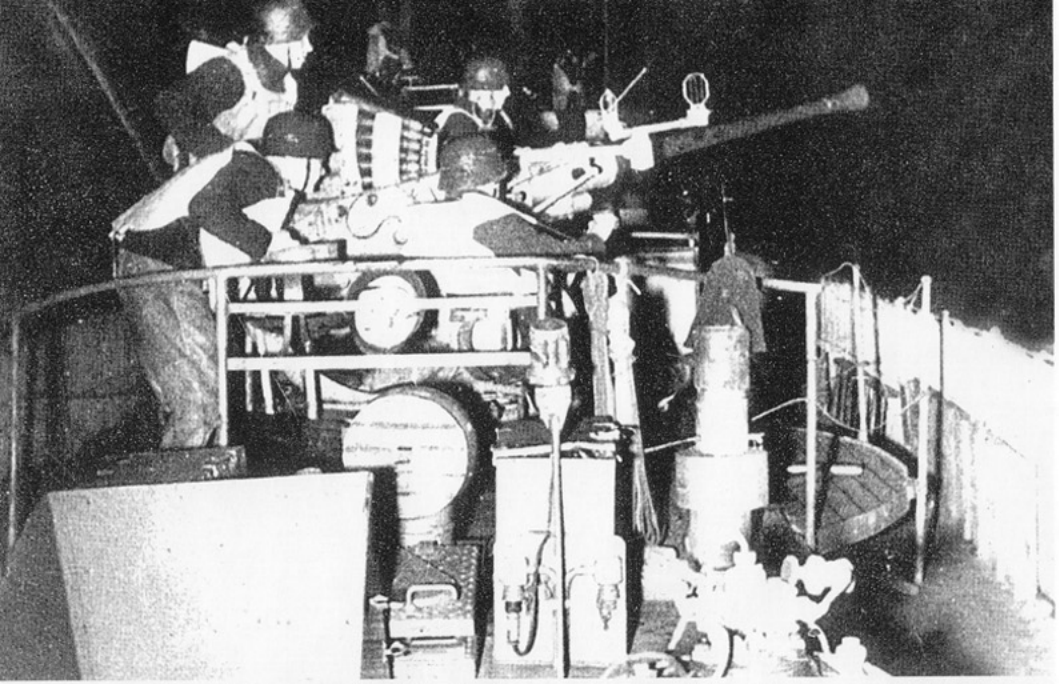


The bow gunner has slewed his C/38 to the port beam. This weapon had a muzzle velocity of 875 M (2871 feet) per second, a horizontal range of approximately 4900 M (5359 yards), and a vertical range of 3700 M (12,139 feet). (*"Die Kriegsmarine"* Photographer PK Warnke)

Two Royal Navy officers examine a surrendered S-100 Class boat in 1945. A 2 CM *'Zwilling'* (Twin Mount) is fitted amidships. A utility box and a helmet rack are nonstandard additions to the rear of the gun shield. Ready ammunition clips were stored in the locker just aft of the striker rail. This *S-boot* has the simplified late-war torpedo cradles. (J. Lambert)

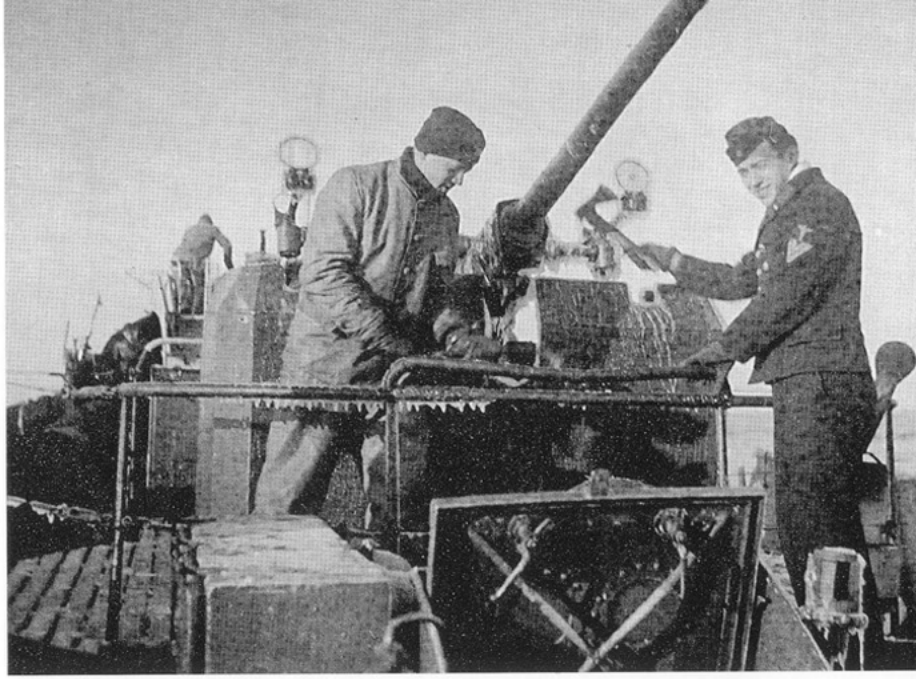


A 4 CM Bofors *Flak* 28 cannon is mounted on the aft deck of the S-38b Class *S-boot* S-91. Germany built this Swedish-designed weapon under license for *Kriegsmarine* service. Clips of ready ammunition were stowed in lockers forward and aft of the gun. S-91's aft deck and superstructure was painted a dark gray. Another *S-boot* cruises in S-91's wake in the distance. (E.J. Bakker)



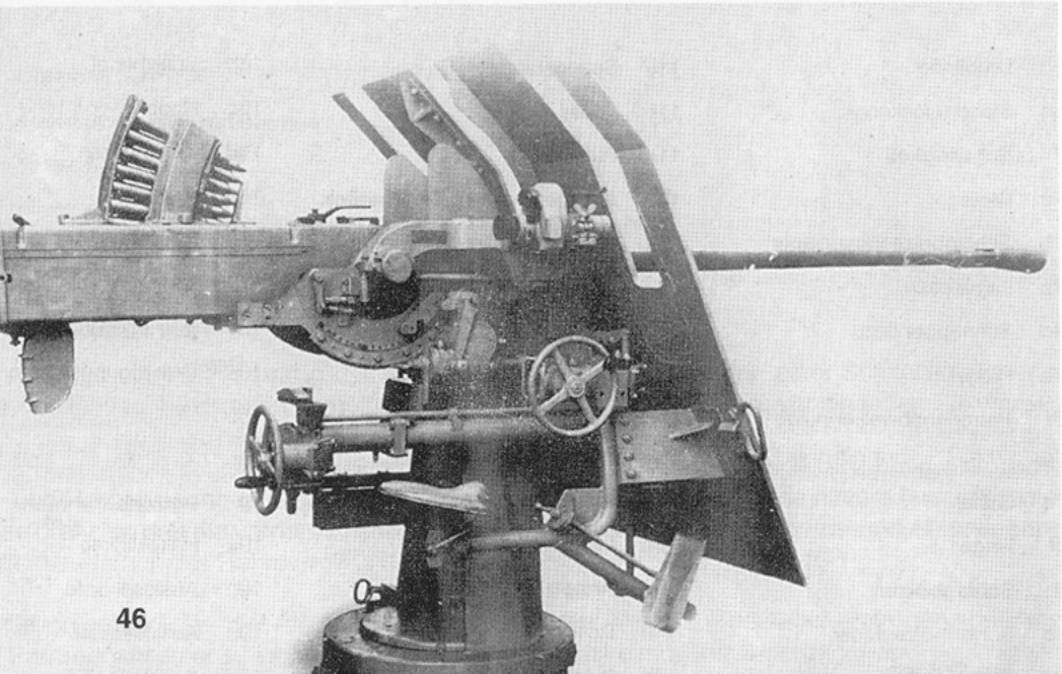
The crew of an unshielded 4 CM Bofors prepare for night action on an S-38 Class boat. *S-boote* armed with this weapon took the rear position when retreating from an ambush to discourage pursuit. The Bofors gun's elevation range was -15° to +90° and its rate of fire was 128 rounds per minute. (PK Rolf Krönke via PT Boats, Inc.)

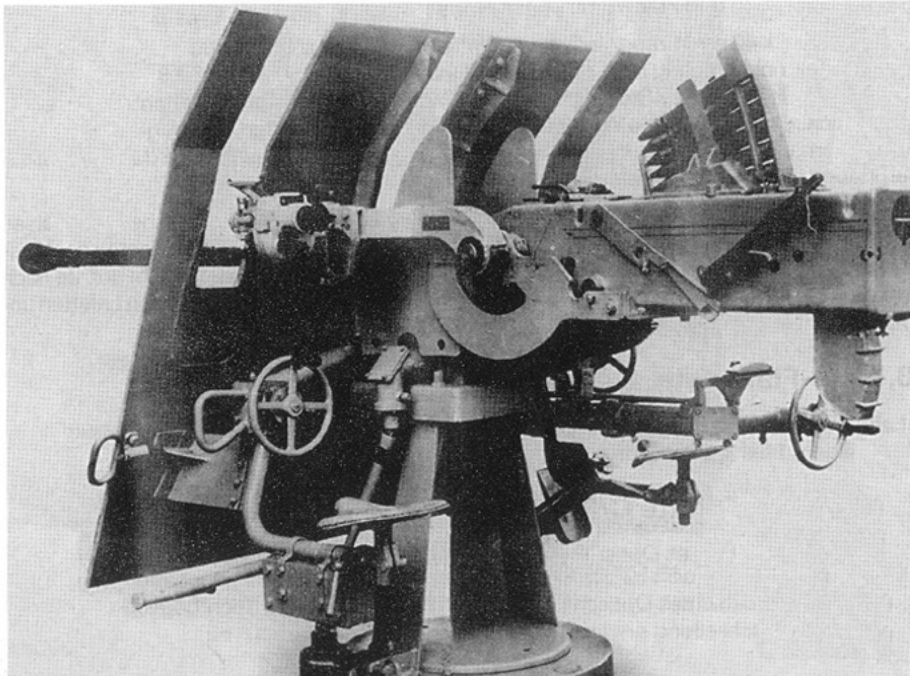
Rheinmetall-Borsig specifically designed the 3.7 CM *Flak* M42 as a shipboard anti-aircraft weapon. It required a crew of only three to four men, which made the gun ideal for the *S-boote*. This *Flak* M42 is fitted to an early C/36 mount. The wheel on the gun's right side controlled elevation, which ranged from -10° to +90°. (Royal Danish Navy)

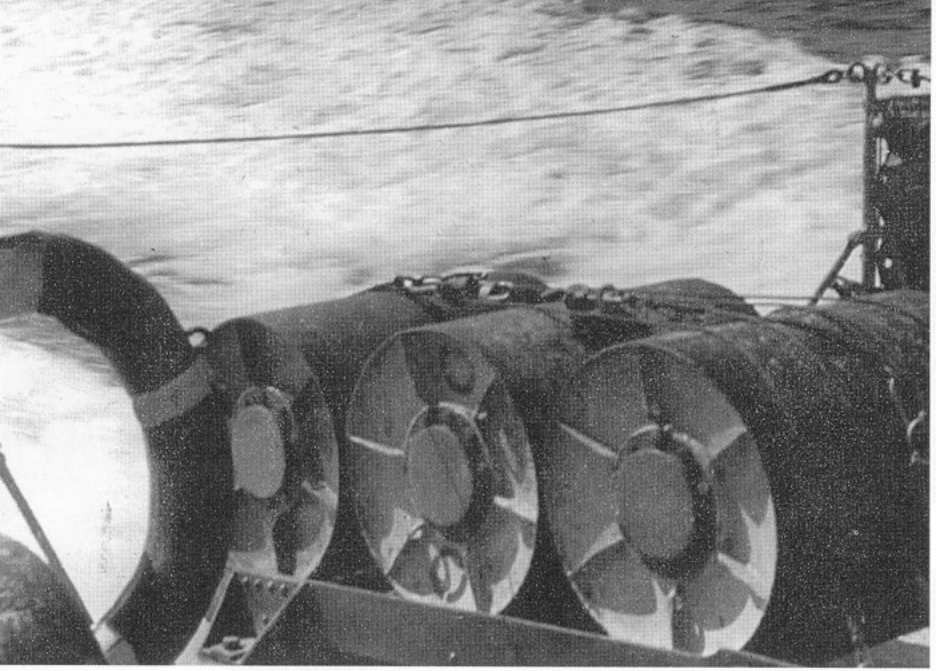


Two sailors chip ice from the shielded 4 CM cannon aboard S-91 during a winter cru
The Germans designed metal shields for the Bofors guns installed on their warships. T
weapon had a maximum range of 10,000 M (32,808 feet) and a maximum ceiling of 700
(22,966 feet). (E.J. Bakker)

The *Flak* M42 was specified as standard for the S-100 Class in 1943. This weapon ha
six-round ammunition clip loaded in its breech; the *Flak* M42 normally used five-ro
clips. It had a firing rate of 190 rounds per minute. The *Flak* M42's anti-aircraft ceiling
4800 M (15,748 feet), while its range at 45° was 6400 M (6999 yards). (Royal Danish Na



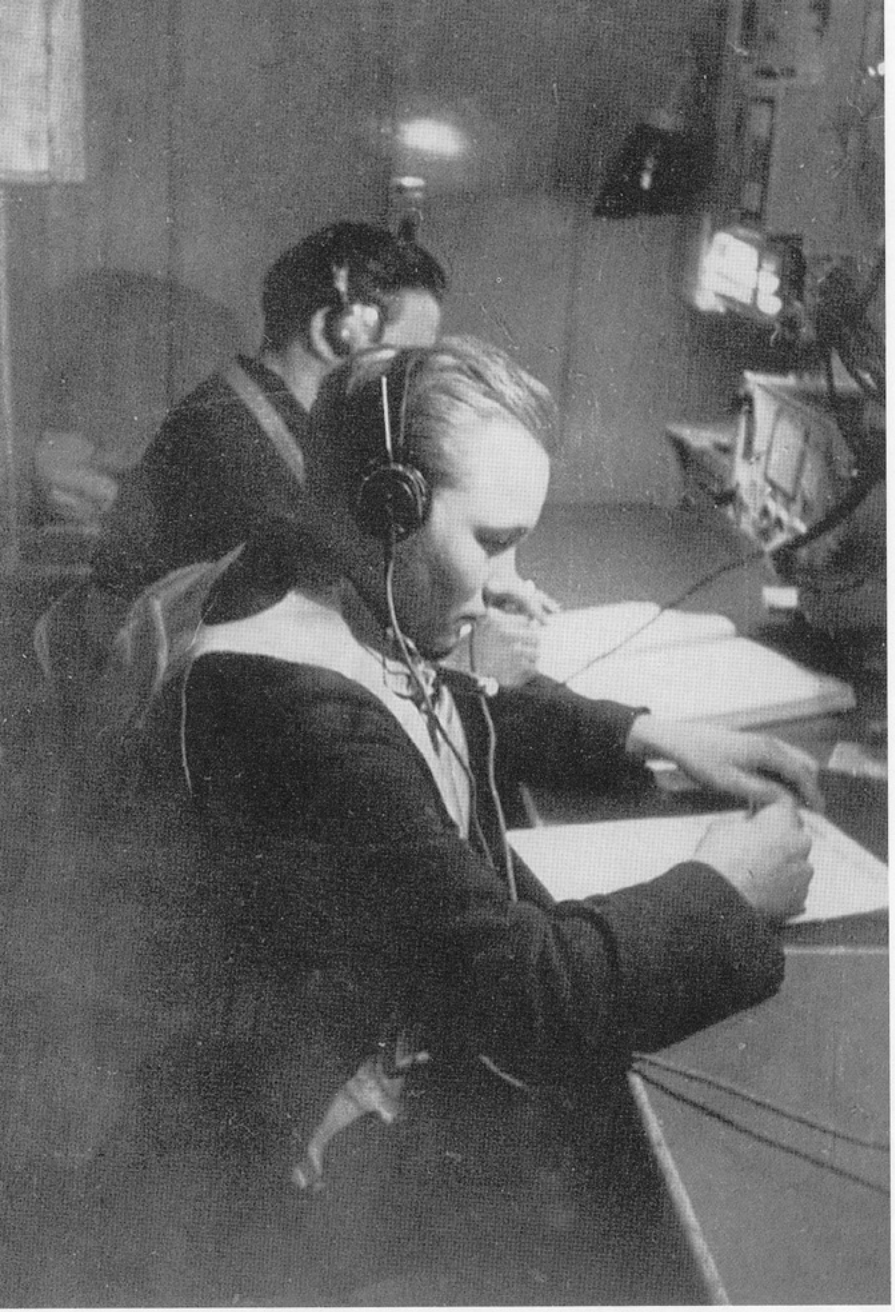




Three depth charges are mounted on the stern rack of a *Schnellboot* engaged in a daylight Anti-Submarine Warfare (ASW) sweep in the Gulf of Finland. Each charge was released by manually disconnecting the individual cables that lashed it to the rack. German depth charges ranged in weight from 139 KG (306 pounds) to 240 KG (529 pounds). A ring life preserver is mounted near the rack's aft edge. (PT Boats, Inc.)

Sailors ready a Type UMB mine for *S-boot* deployment. This contact mine was 0.8 M (2 feet 7.5 inches) in diameter with a 40 KG (88 pound) explosive charge. The weapon was moored at depths ranging from 65 M (213 feet) to 300 M (984 feet). Clandestinely laid mines such as this were effective and continued to menace English Channel shipping into the 1950s. (PK Rolf Krönke via David Krakow)

Sailors prepare an S-38 Class *Schnellboot* for a mission in the Gulf of Finland. A depth charge is lowered to the boat from the flotilla tender, while crewmen install mine rails to the decks. Two baskets of bread lowered from the tender to the boat's mid-deck will fortify the vessel's crew. Two other *S-boote* are moored to port of this vessel. (H. Bürger)



**Long-range radio operators work at their post below decks. The *S-boot*'s radio room was located on the port side, below and forward of the wheelhouse. Each *Funker* (Radio Operator) wears headphones to listen to the incoming message, which was usually sent via Morse code. The FuG/VaU radio is mounted on the bulkhead between the two operators. (PK Rolf Krönke via David Krakow)**

**A *Steuermann* (Helmsman) mans the wheel inside the enclosed wheelhouse, while a *Funker* mans the Lo 1 UK short-range Very High Frequency (VHF) radio set. The voice radio allowed for rapid communication between flotilla vessels. A clock is mounted on the bulkhead over the helmsman's left shoulder. The finely crafted wooden wheel and brass clock in this otherwise modern attack craft were tributes to naval tradition. (PK Rolf Krönke via David Krakow)**

# Radio

*Schnellboote* usually operated at night in formations, which made communication especially vital to navigation, formation keeping, target location, and attack coordination. A Type FuG/VaU[1] receiver/transmitter provided high frequency ship-to-shore radio communication, general reception, and long range communication. It was mounted in the radio room forward and below the wheelhouse, which also served as the radioman's quarters. A second radioman stood by the helmsman as part of the bridge crew. He operated a short range Very High Frequency (VHF) type Lo 1 UK 35 voice transmitter receiver in the wheelhouse, which enabled rapid communications between other vessels in the flotilla. *S-boote* were commonly identified by their captain's nicknames, as in the Allied navies. When conditions allowed, communication between boats was undertaken by signal lamp or flag semaphore. The earlier *S-boote* had mechanical semaphores and signal lamps on the large mast for signaling. These masts – located on the centerline aft of the wheelhouse – were removed from early vessels during wartime to reduce their visibility and radar reflection. Large signal masts were not included on the S-38b Class and later *Schnellboote*.

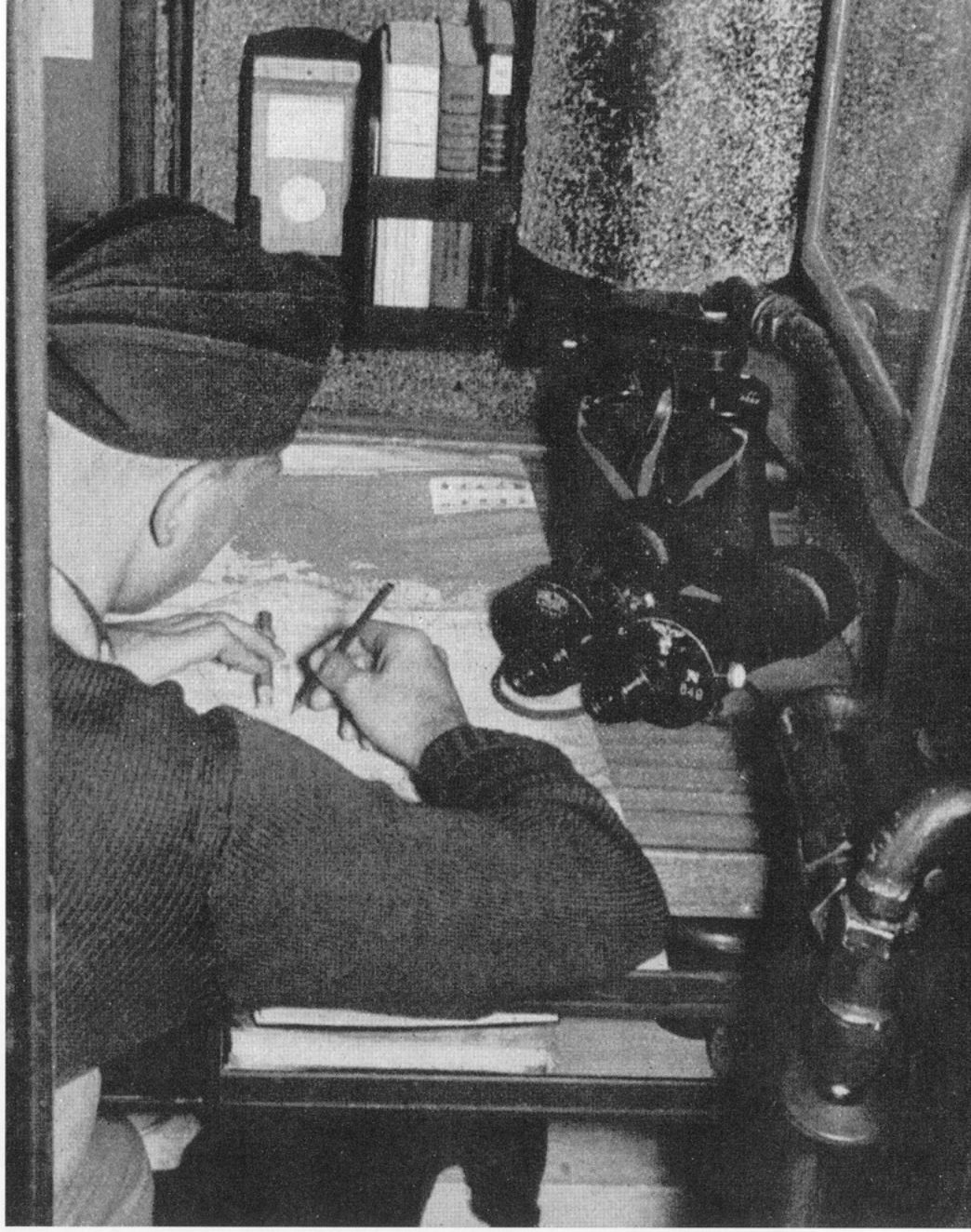
[1]FuG: *Funkgerät*; Radio Device

**The S-38 Class boat *Wulff* leads two other *S-boote* out on patrol. The boat's name is painted on the bridge's side. A radio antenna mast is mounted on the aft starboard section of the bridge. A whimsical wooden parrot decorates the large loop-shaped Radio Direction Finding (RDF) antenna. The *Kommandant* wears a captured French fleece jacket. Narrow gold embroidery on his cap visor indicated he was a junior officer, between *Leutnant* (Ensign) and *Kapitänleutnant* (Lieutenant). (PK Tomann via D. Krakow)**

# Navigation

Maneuvering a *Schnellboot* in combat required precision navigation and steering under the most trying of conditions. The *S-boot*'s few navigational tools were laid out in a simple and logical manner. The navigator plotted the course on a small table in the rear of the wheelhouse. Several compasses were carried on board, including a central compass mounted in a binnacle amidships. The captain, navigator, and helmsman had smaller compasses mounted in their respective positions. Reserve compasses were mounted in various positions around the boat. Many *S-boote* were equipped with an echo sounder to assist in navigating shallow waters.

Radio Direction Finding (RDF) equipment was standard aboard *S-boote*. Its distinctive loop antenna fitted into a socket at the rear of the wheelhouse, although it was not always mounted. RDF was used to pinpoint the boat's precise position by triangulating radio transmissions from known positions ashore. A skilled operator could use it to locate the position from which an enemy ship was transmitting.



**The navigator plots the *S-boot*'s course at his desk in the wheelhouse. The *Kommandant* will consult the navigator and his maps though a shuttered window connecting this small cabin and the bridge. The interior bulkheads were painted with a non-reflective dark paint. It appears that the captain and first officer have left their Zeiss 7x50 binoculars on the navigator's table for safekeeping. (H. Bürger)**

# Radar and Detection

*Schnellboote* relied chiefly on constant radio contact with shore-based radar installations and visual/radio monitoring stations for long distance location of, and vectors to, enemy ships. Shore-based radar was effective to within 18 KM (11 miles) of the English coast in good weather and developed to great efficiency closer to the occupied coast.

German hydrophones (a sensitive directional microphone array mounted outside the hull below the waterline) were also extremely effective. These were able to locate a PT boat travelling at 30 knots (35 MPH/56 KMH) from a range of 18 KM. It was effective even while underway. They emitted no telltale signals to the enemy and were thus preferred to radar. Hydrophone performance was degraded as the detecting vessels' speed increased.

After an initial lead, Germany began to lag seriously behind the Allies in the development and use of ship-mounted naval radar. Nevertheless, the *Kriegsmarine* sought to equip some *S-Boote* with appropriately small radar antenna. The earliest application was the FuMO 71[1] *'Lichtenstein B/C.'* This was a fixed radar array measuring approximately 1.3 M (4.3 feet) by 1.6 M (5.2 feet) that could scan a 35° arc ahead of the boat. Its range was limited to approximately 2-6 KM (1.2-3.7 miles), but it was extremely accurate for ranging and useful for navigating in darkness and fog. It was adapted from the Luftwaffe's obsolete FuG202 airborne radar and went into limited service on *Schnellboote* in late 1943. Experiments were made with this antenna mounted to a rotatable mast. This configuration, designated FuMO 72, further enlarged the *S-boot*'s radar signature, earning it the derisive name 'shell collection basket.' Only three sets were field tested before it was deemed unsatisfactory.

In March of 1944, an experimental set designated FuMO 62 *'Hohentwiel S'* was developed and tested for *Schnellboot* use. It was based on the Luftwaffe's FuG 200 Hohentwiel Anti-Surface Vessel (ASV) radar. The FuMO 62 had a greater range – approximately 10 KM (6.2 miles) – and more accuracy than the FuMO 71, however, the 1.2 M (4 feet) by 1.2 M rotating antenna caused a similar unacceptable increase in radar signature.

At least two boats, S-122 and S-127, served as the testbeds for the FuMO 81 *'Berlin S'* type radar in 1944. The *Berlin* radar was an outgrowth of the Luftwaffe's *'Rotterdam'* apparatus. It was an efficient microwave search radar that operated on a 9 CM (3.5 inch) wavelength with a peak power of 18-20 kilowatts (kW) and an effective range of approximately 30 KM (19 miles). The rotating antenna consisted of four end-firing plastic rods housed under a Plexiglas dome mounted on a bipod mast behind the bridge. This arrangement was a precursor to the modern naval 'radome.' None of the FuMO 81 sets evaluated met with as great a success as their counterparts on British and American boats.

The ever resourceful German engineers recognized the disparity between the high quality Allied radar and the less than satisfactory German sets. They developed a number of effective radar counter measures, including passive radar detection and ranging. Radar detection gear gave early warning of enemy forces based on their radar emissions while still beyond the useful range of the enemy's own radar. The apparatus effectively enabled the *S-boot* to detect and generally locate the enemy's presence without being located itself. The FuMB[2] Ant 3, codenamed *'Bali 1,'* antenna was a commonly used passive radar detection sensor. The *'Bali 1'* antenna was part of the FuMB 29 *'Bali-Anlage'* radar surveillance system. It could be used with an FuMB 4 *'Samos'* receiver (90-470 Megahertz; MHz), an FuMB 9 frequency indicator (146-264 MHz), or an FuMB 10 *'Borkum'* signal detector (100-400 MHz). The signals were fed through a booster to a FuMZ 1[3] oscilloscope, where the operator viewed and interpreted the information.

A similar detector, the 110-300 MHz FuMB 32 *'Flores,'* was developed specifically for the *S-boot*. It was capable of direction finding and was mounted on a light rotating mast. The FuMB 32 was approximately 50 CM (20 inches) wide and also used the 'Samos' receiver or a similar device. The FuMB 24 *'Cuba 1a'* provided relatively accurate long-range detection particularly in the 9 CM wavelength and its compact antenna was also ideal for use aboard a *Schnellboot*. A *'Flores'* and a *'Cuba 1a'* antenna were often fitted to the same mast, which rotated via a hand wheel in the operator's cabin directly behind the bridge cockpit.

The *'Naxos'* detectors FuMB 23 and FuMB 28 began service on *Schnellboote* in mid 1944 and utilized a futuristic rotating detector unit housed under a Plexiglas' radome referred to as antenna type ZA 290M. They provided accurate long range directional location of enemy radar signals from air or sea, particularly in the 9 CM wavelength.

1FuMO: *Funkmess-Ortung*; Radar-Direction Finder, Active Ranging.

2FuMB: *Funkmess-Beobachtung*; Radar-Detector, Passive Detection.

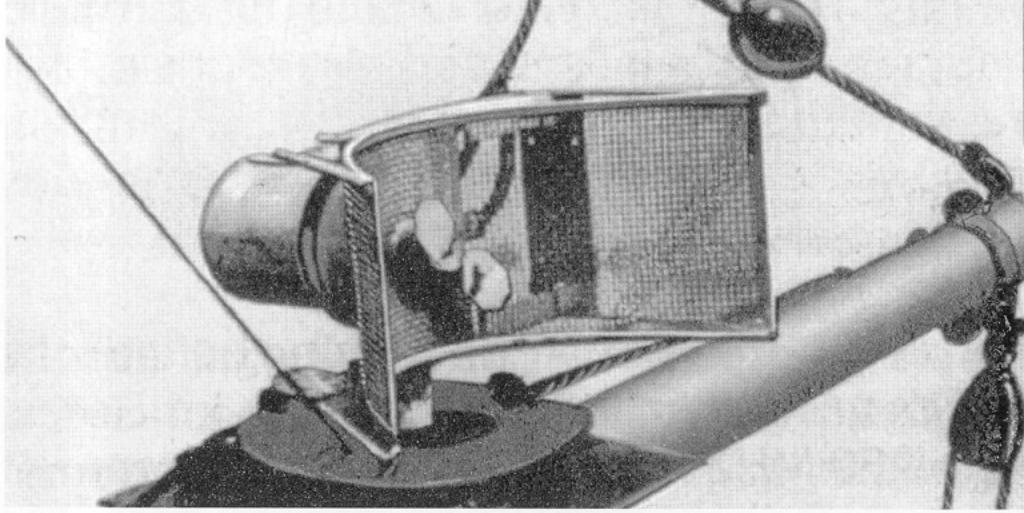
3FuMZ: *Funkmess-Zusatz*; Radar-Addition (i.e., high-precision bearing)

**An S-100 Class boat is moored in a Dutch canal. An FuMB 24 *'Cuba 1a'* long-range radar detection antenna is mounted atop the short mast on the port side of the bridge. Just below the FuMB 24 antenna is one for the FuMB 32 *'Flores'* direction finding radar detector. The operator directly aft of the bridge cockpit rotated this mast a full 360° to detect enemy radar emissions. A triangular pennant flies from a flagstaff on the starboard side of the *Kalotte*. A gangplank was extended from the deck in front of the *Kalotte* to the pier. (Lürssen)**

Other detection units included the FuMB 26 *'Tunis'* antenna, which was used on several S-151 and S-30 class boats in the Mediterranean. Numerous other units were in the testing stages towards the end of World War Two. These included the 2-20 CM (0.8-8 inch) wavelength detection multi-antenna *'Libyen'* housed in a rectangular box resembling a traffic light and the miniature hand-held FuMB 33 *'Lilliput'* detection gear for the 9 CM range. The latter was intended for use on the LS vessels and other small craft.

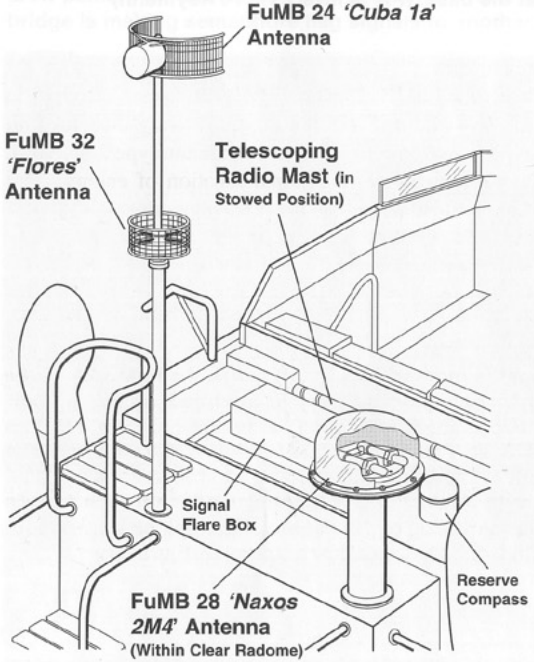
The Germans further exploited the weakness of enemy radar by deploying radar decoy buoys, which mimicked a *Schnellboot*'s radar signature to confuse the enemy. Other experiments attempted to find materials that would conceal the boats from enemy radar by absorbing or scattering radio signals. A reflection dimming rubberized coating known as *'Tarnmatte'* (Camouflage Mat) was developed and used on *U-boote* (submarines). Although tests to camouflage *S-boote* using measures similar to *'Tarnmatte'* were partially successful at certain wavelengths, the system apparently was not developed for operational use.

Experiments with passive infrared night vision equipment showed great promise, but by the war's end even the most advanced versions still required a fairly steady platform and clear weather conditions. These rendered the equipment ineffective in fog or on moderate seas. Passive infrared night vision devices were used with success on heavier ships and by land-based observation points.

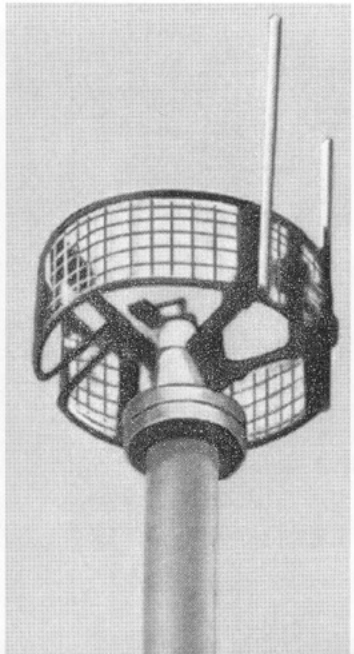


**The FuMB 24 *'Cuba 1a'* radar detector was used on *Schnellboote* and other *Kriegsmarine* warships. Its antenna was mounted on a mast where it could provide adequate long range radar detection to warn the vessel's captain. (US Naval Technical Mission/US Naval Historical Center)**

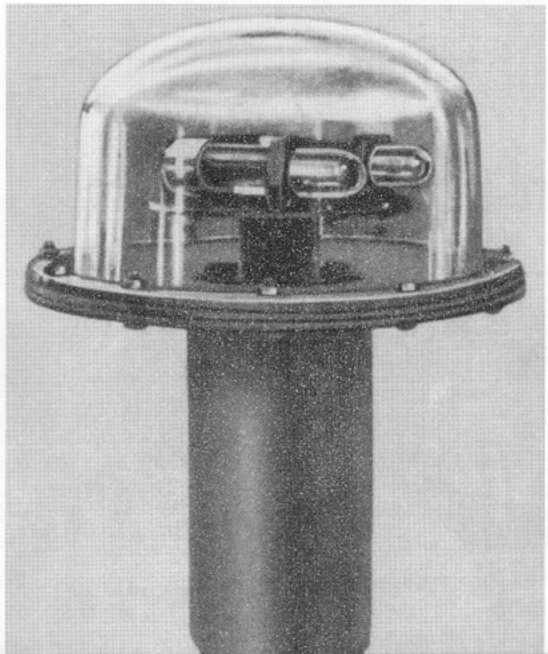
## Radar Detector Antenna Placement (Immediately Aft of Bridge)


FuMB 24 'Cuba 1a' Antenna
FuMB 32 'Flores' Antenna
Telescoping Radio Mast (in Stowed Position)
Signal Flare Box
Reserve Compass
FuMB 28 'Naxos 2M4' Antenna (Within Clear Radome)

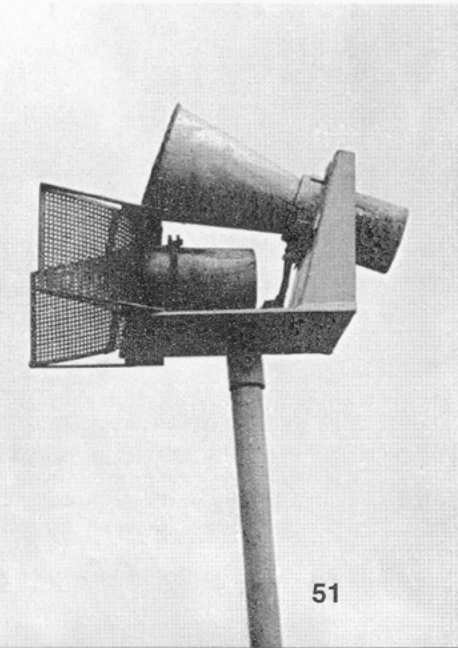
**Another radar detector used on *Schnellboote* was the FuMB Ant 3 *'Bali 1.'* This antenna was commonly fitted to many *S-boote* during the war. The FuMB 32 *'Flores'* antenna was similar in appearance. (US Naval Technical Mission/US Naval Historical Center)**



**The FuMB 23 and similar FuMB 28 *'Naxos'* detectors both used ZA 290M antennas, which were enclosed within a clear radome. This long-range radar detector entered *S-boot* service in mid-1944. (US Naval Technical Mission/US Naval Historical Center)**



**Several S-151 and S-30 boats deployed in the Mediterranean were equipped with the FuMB 26 *'Tunis'* radar detector. This device was also fitted to *Kriegsmarine* submarines and destroyers. (US Naval Technical Mission/US Naval Historical Center)**



# Camouflage, Colors, and Insignia

The first *Schnellboote* were painted in the German Navy's traditional light gray *Hellgrau 4* (approximately FS16515). Methodical pre-war experimentation with color schemes confirmed what seamen had noticed for centuries: at sea after dark, small, light-colored vessels were more difficult to see than darker-colored ones. Although this seems counter-intuitive, pale shades blend with the horizon line between sea and sky. Since *Schnellboot* tactics called primarily for operations under the cover of darkness, vertical surfaces were factory painted a nearly white pale gray appropriately referred to as *'Schnellbootweiss'* (approx. FS27875).

Below the waterline, early boats were painted anti-fouling black *Schiffsbodenfarbe Grau 1* (approx. FS36081). Later vessels had this area painted with brownish-red anti-fouling *Schiffsbodenfarbe Rot 5* (approx. FS20152), or a similar color. They usually retained the anti-fouling black as a boot topping stripe. Horizontal surfaces were painted black, various shades of gray, or occasionally medium green. This served both as camouflage from air observation and to hide scuff marks from the crew's boots. Maintenance and cleanliness were emphasized on typical *S-boote*; these hard-worked vessels were kept remarkably clean.

In wartime, some boats were camouflaged for daylight operations. Boats involved in the invasion of Norway in April of 1940 were hastily painted overall dark gray (approx. FS26187). After the invasion, they were repainted in *Schnellbootweiss*. In southern waters, the decks were painted a pea green *Hellgrün 35.1* (approx. FS34258) or olive *Dunklegrün 35.3* (approx. FS34097) to better match the warm algae-tinted waters. Those serving in the Black Sea also received red/white air recognition bow stripes following the Italian practice. In the mid-war period, a distinctive gray and tan scheme of long blotches was applied to a number of S-26 and S-38 class boats, probably locally mixed grays and *Hellbraun* 36.1 (approx. FS20318). Other boats received a stripe scheme that mimicked waves and was probably a combination of blue *Dunkelblau 33.3* (approx. FS25052) and dark gray *Dunkelgrau 2* (approx. FS26280). Vertical surface camouflage was continued on the canvas dodgers. Horizontal surfaces on some English Channel boats were painted with large splotches of *Schnellbootweiss*. The photographic evidence indicates that armored bridge boats were rarely over-painted with camouflage. The authors have been able to document only one temporary pattern of dark gray blotches applied in June of 1944, when the 6th *S-bootsflotille* (*Schnellboot* Flotilla) abandoned their base in Finland and traveled to Germany in daylight.

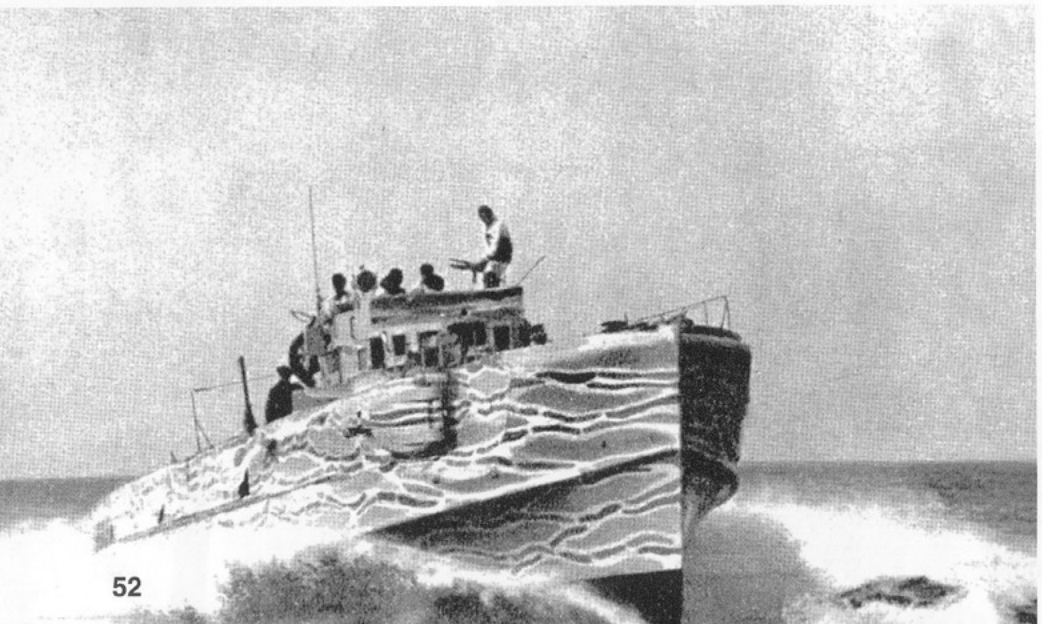
*Schnellboote* also carried assorted flags of different Allied and neutral nations, which were sometimes flown in order to confuse coast-watchers and enemy ships. These foreign flags were official *Kriegsmarine* issue.

In the Summer of 1933, *Reichsmarine* warships were decorated with a *Reichsadler* (Reich eagle and swastika emblem), which was relief-cast in bronze. (The *Reichsmarine* became the *Kriegsmarine* on 21 May 1935.) Until they were removed in 1940, *Schnellboote* prominently displayed these to port and starboard. When war broke out in September of 1939, all hull numbers were painted over as a security measure. In 1945, the Allies ordered hull numbers painted on the bows for inventory purposes.

During the war, many boats were emblazoned on the bridge sides with individual and flotilla markings. The boat's radio call sign or symbol was sometimes also painted on the stern.

Prior to October of 1941, qualifying *S-boot* crewmen wore the destroyer badge. By decree of *Grossadmiral* (Grand Admiral) Erich Raeder (*Kriegsmarine* Commander-in-Chief) on 30 May 1941, a distinctive badge was designed for *Schnellboot* personnel. It was awarded to crew who participated in 12 operational missions or were wounded through enemy action. Official

**An S-38 Class *S-boote* cruises at high speed in the Baltic Sea. This vessel was camouflaged for daytime operations against Soviet shipping. The camouflage consisted of dark blue and blue gray waves on the *Schnellbootweiss* base color. (PK Schwarz via P. Reymann)**

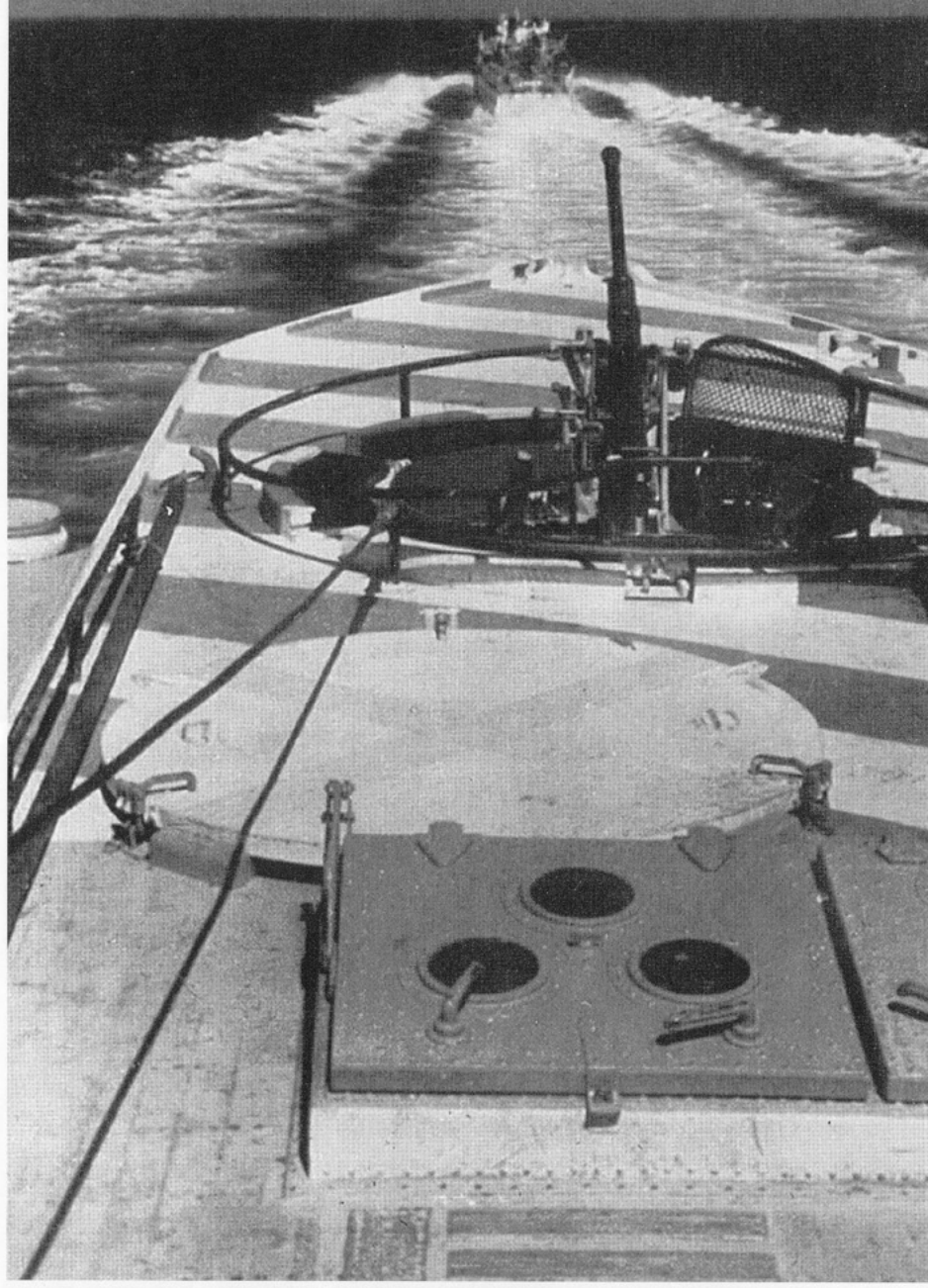


**Another S-38 Class vessel moves directly astern of another boat in the Baltic. It is painted in a different dark blue and blue gray wave pattern. There was no standard pattern for this camouflage, which was painted at the base. (PK Schwarz via P. Reymann)**

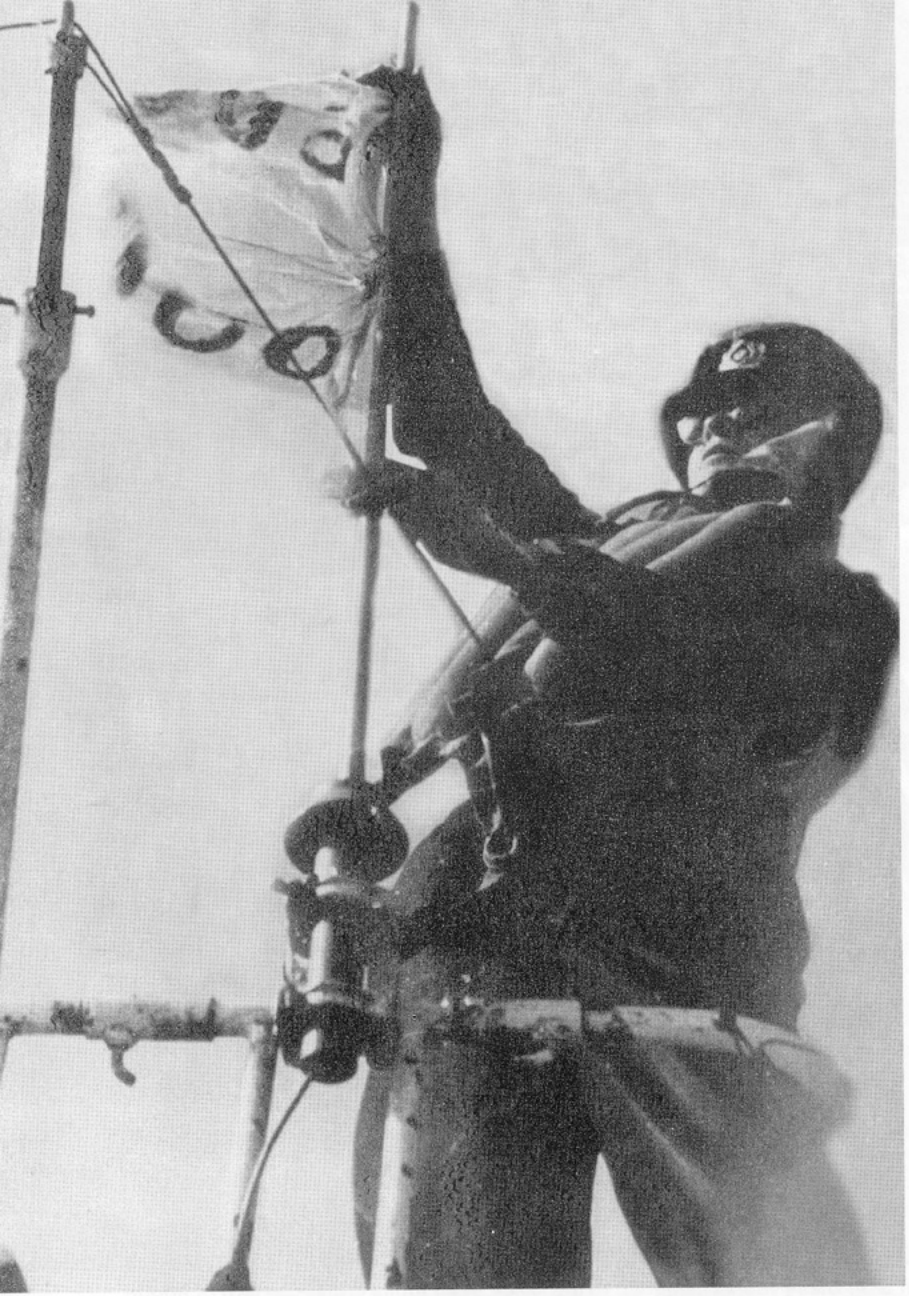
**An S-38 Class *S-boot* cruises in Norwegian waters in 1942. This *6th S-bootsflotille* vessel is painted in hard edged splotches of browns and grays over the *Schnellbootweiss* finish. The camouflage allowed the boat to better match the snow-covered fjord landscape. (E.J. Bakker)**

issue commenced in October of 1941. Apparently the first badge, which depicted an S-30 Class boat, was not well received and a second badge depicting an S-38 Class vessel was authorized in January of 1943. The eight *S-boot* captains who earned *Eichenlaub* (Oak Leaves) to the *Ritterkreuz* (Knight's Cross of the Iron Cross) were each awarded the *Schnellboot* badge with diamonds.

**Another 6th Flotilla's S-38 Class boat is underway during its short 1942 deployment to Norway. Its crew painted the brown and gray splotches in another pattern than its sister boat. A sailor atop the bridge is making semaphore flag signals to another vessel. (E.J. Bakker)**



**An S-38 Class vessel assigned to the Black Sea Flotilla cruises astern of another *S-boot*. The bow is painted in diagonal red and *Schnellbootweiss* stripes as an air recognition measure. The rest of the deck is a green color, which matched the warm algae-tinted water of this region. This S-38 Class boat is equipped with the first pattern 2 CM bow gun on a simple Scarff ring without the pantograph gun sight fitted to later vessels. (PK Krönke via D. Krakow)**



**A *Maat* (Petty Officer) attaches two kill pennants to his *S-boot*'s radio antenna mast. Each pennant is marked with the approximate tonnage of the enemy vessel sunk. These banners were displayed when the boat returned to port after a successful sortie. He wears a pneumatic life vest as much for safety as a bit of extra warmth. (PK Krönke via D. Krakow)**

# Tactics and Deployment

*"It is incomparably more effective to sink a whole cargo than to have to fight the unloaded personnel and material separately on land at a later date."* This was how German *Führer* (Leader) Adolf Hitler summarized the underlying strategy of *Schnellboot* operations. Early in the war, *Schnellboot* captains pressed home many daring close quarters attacks on Allied merchant ships and convoys. Luftwaffe air support enabled them to travel to and from distant ambush areas during daylight hours. These tactics employed against the Western Allies grew more conservative in the light of the Allies' growing defenses and of the *Schnellboot* flotillas' thinning ranks. A June of 1944 US Navy intelligence report (which called *S-boote* 'E-Boats') summarized *Schnellboot* operations as follows:

*"E-Boats favor night conditions of mist and calm sea and luminous conditions such as a half moon. They leave their bases in packs and on reaching the convoy lanes, split into flotillas of six. Boats with the 40MM* [cannon] *take stern positions in formation. They move in column formation and are generally given accurate radar information from shore. Using hydrophones and elementary radar, they move slowly and quietly up for attack (they may lay quiet moored to a Channel buoy) and after firing their torpedoes use evasive tactics similar to PTs* [US Patrol Torpedo boats]. *The flotilla leaders decide the tactics, and their policy up to the present has been to avoid combat. These boats attack British small craft only if the prey is crippled or vastly inferior in fire power..."*

*"E-Boats are high speed torpedo boats; neither hull nor armament are capable of resisting the slower British boats. Committed to a policy of conservation of their numbers, they decline gunnery duels. They shadow stragglers or damaged boats, make quick runs and break away, and even conclusive superiority recently has failed to lure them into point blank range. Their marksmanship is mediocre unless given a point of fire by long bursts of tracers. They fire high and often fail to close to effective range before firing."*

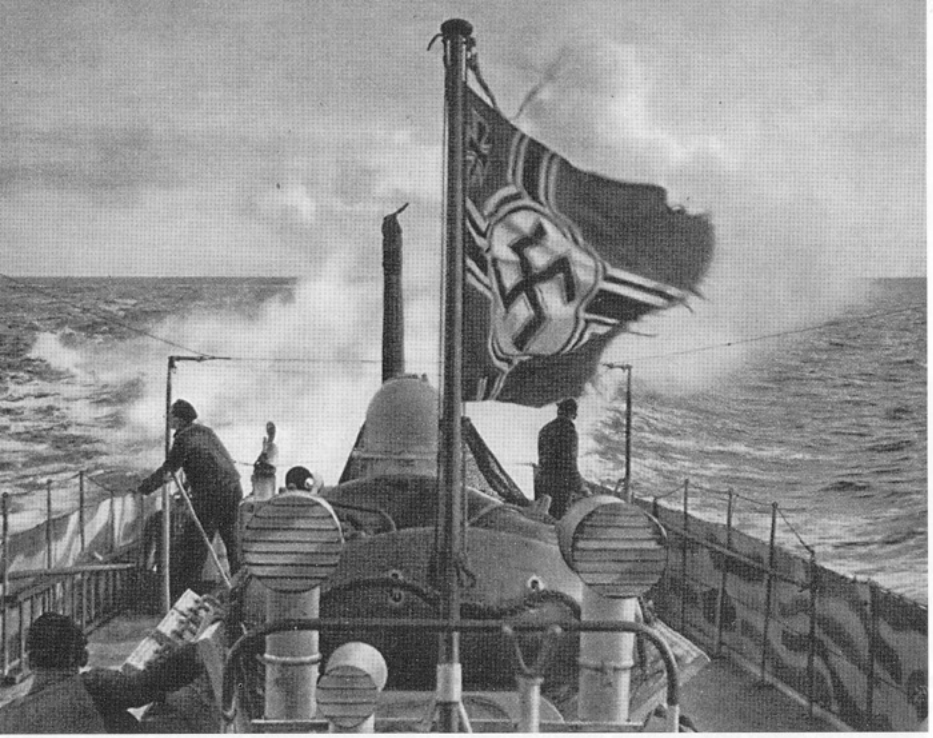
*"British craft cannot catch them and rarely attempt a running fight with them. When encountered, E-Boats usually ran in formation on the flotilla leader, turning away by a ship movement to right or left from column. When circumstances force them to scatter, they apparently have a prearranged rendezvous at certain bearing and distance from any scramble."*

# Conclusion

Unlike the beleaguered capital units of the *Kriegsmarine*'s surface fleet, the *Schnellboote* saw constant combat from the first to the last days of World War Two. Their service was nothing short of exemplary. In the English Channel, Baltic Sea, Black Sea, North Sea, Mediterranean Sea, and Barents Sea, the *Schnellboote* sank 101 merchant ships totaling 214,728 tons. They also sank 12 destroyers, 11 minesweepers, eight landing ships, six MTBs, two gunboats, a torpedo boat, a minelayer, a submarine, and numerous small merchant craft. They damaged two cruisers, five destroyers, two frigates, three landing ships, a repair ship, a naval tug, and numerous merchant vessels. Mines laid by *Schnellboote* sank 37 merchant ships totaling 148,535 tons, a destroyer, two minesweepers, and four landing ships.

The intensity of combat is indicated by the fact that the Schnellboot service produced 23 Knight's Cross winners – eight of whom were further distinguished with the Oak Leaves – and 112 *Deutsches Kreuz* (German Cross) in Gold winners. It is unarguable that the *Schnellboot* force served honorably. It is fitting that their final days were dedicated to a humanitarian mission: assisting in the mass seaborne evacuation of German civilians and soldiers from the Baltic States to the relative safety of Germany.

The *Schnellboot* was an investment in the concept that quality and skill will outclass mass production on the battlefield. Although the concept was tactically correct, it did not account for the strategic strain on

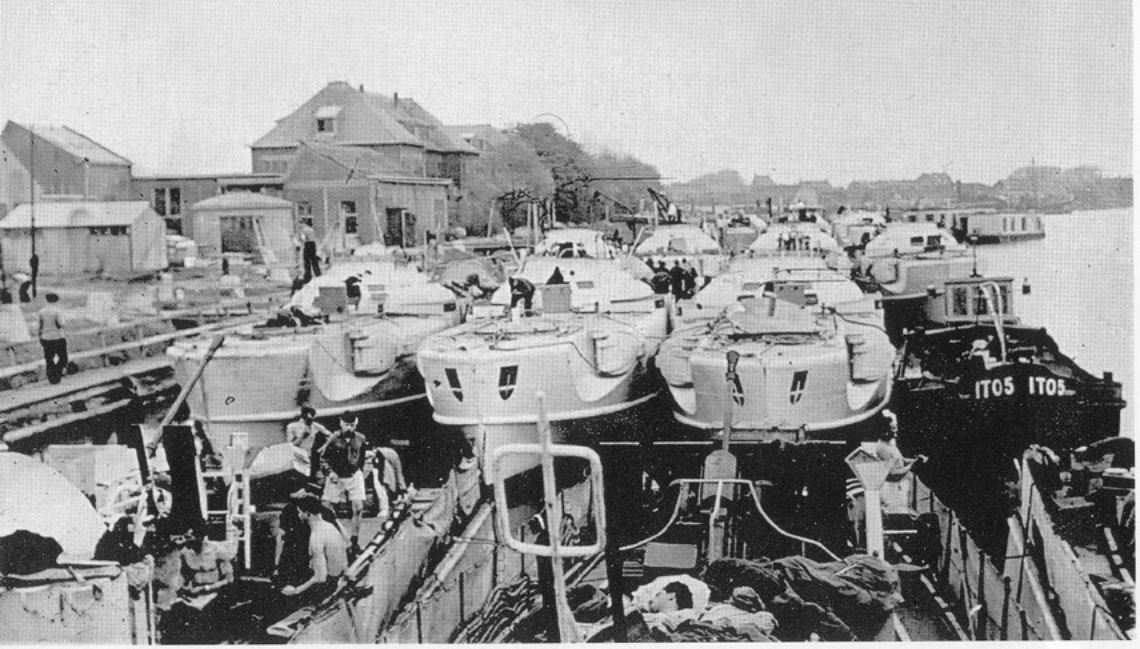


**(Above) An *S-boot* lays down a smoke screen from its deck-mounted smoke generators. This smoke shielded the boat from the eyes of enemy vessels, particularly when retiring from an engagement. The *Reichkriegsflagge* (German naval ensign) flies smartly from the midships mast, while the black and white *Kommandowimpel* (Captain's Pennant) is displayed above it on the same mast. The wave camouflage pattern is painted on the inboard side of the canvas dodgers. (PK Schwarz via D. Krakow)**

**(Above Right) An *S-boot*'s 2 CM gun crew fires away during a night action. Nocturnal battles were intense, with ranges so close and visibility so poor that collisions were a constant threat. The 2 CM tracer round lacked adequate stopping power, but it did have a certain psychological impact on both friend and foe. (PK Mehl via D. Krakow)**

Germany's manufacturing and fighting capabilities over the course of a lengthy two-front war. The *Schnellboot* was probably the most effective torpedo boat of World War Two and their crews fought gallantly, but in the final analysis, they were doomed from the start by the strength of Allied mass production.

**(Right) One *S-boot* cruises astern of another boat while starting a night patrol. The sun sets behind the trailing vessel. *S-boote* crews preferred night patrols, due to the lessened risk of air attack and detection by surface vessels. Two crewmen stand at their posts on the near boat's aft deck. Canvas dodgers are extended over the aft deck railings and an inflatable dinghy is stowed on deck. Will the crews of both vessels see the sun rise again? (PK Krönke via PT Boats, Inc.)**



Captured *S-Boote* await Allied orders in Den Helder, the Netherlands immediately after the German capitulation in 1945. Among these boats are elements of the *5th* and *6th S-bootsflotillen*. The cruciform object in the lower center is the field-modified depression rail striker of a twin 2 cm *Flak*. This striker contacted a fixed rail, which prevented the gunner from firing into his own boat. (E.J. Bakker)

# Restoration

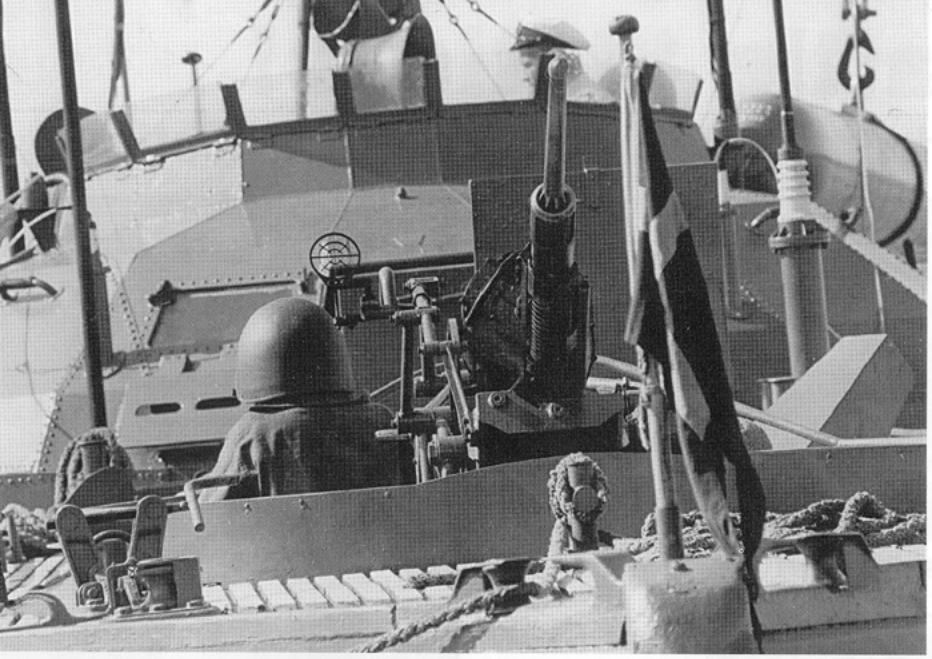
Numerous *S-boote* survived the war and were allotted to the victor nations as war prizes. These included 18 that served in the Royal Danish Navy from 1947 until the last (ex-S-68) was decommissioned in 1965. The British Military Powerboat Trust in England is restoring two original *Schnellboote*, S-97 and S-130, as this book goes to press.

S-97 was laid down on 18 September 1942 and was commissioned into the *Kriegsmarine* on 25 March 1943. It saw action under the command of *Obersteuermaat* (Chief Petty Officer) Wilhelm Waldhausen in the English Channel as well as in the Gulf of Finland as a unit of the 6th *S-Bootsflotille*. Always a lucky boat, it survived a direct hit from a British torpedo that failed to explode.

S-130 was built by Schlichting and commissioned on 21 October 1943. Its *Kommandant* (Commander) was *Oberleutnant zur See* (Lieutenant j.g.) Gunter Rabe and it served in the 9th *S-Bootsflotille* in the English Channel. S-130 and eight other *Schnellboote* took part in the battle of Slapton Sands off southwest England on 28 April 1944. These boats attacked eight American Landing Ships, Tank (LSTs) participating in Exercise TIGER, a mock invasion of Normandy, France. Two LSTs were sunk and a third heavily damaged. The attack took the lives of 197 American seamen and 441 soldiers – more than those who died at Utah Beach on 6 June 1944 (D-Day). In 1945, S-130 was taken as a British war prize and was subsequently used in covert operations in the Baltic Sea.

Dry-docked boats allotted to Denmark by the Office of Military Government of the United States (OMGUS) await overhaul and recommissioning in the Royal Danish Navy in August of 1947. Hull numbers – strictly banned by wartime security – reappeared as a post-war Allied inventory measure. The S-38 Class boat S-97 is docked at lower right. (L. Alring/Royal Danish Navy)

The *Kriegsmarine*'s former S-206 and S-127 were recommissioned as T-55 (left) and T-56 respectively, of the Royal Danish Navy in 1947. They appear well-maintained and unchanged from their original configuration. The Danes renamed T-55 as HÖGEN (P555) and T-56 as ISFUGLEN (P556) in 1951. (L. Alring/Royal Danish Navy)



Antennas bristle on the deck of the Danish vessel HEJRIN, formerly S-117, in 1960. The Danes refitted this S-38 Class boat several times after acquiring it in 1947. Welds on the *Kalotte* joined armored plates, while light sheet metal was bonded with rivets. Curiously, this boat mounts a drum-fed 2 CM Luftwaffe MGFF cannon in the bow. (L. Alring/Royal Danish Navy)

The Danish boat T-52 (ex-S-107) cruises off the Danish coast. This vessel mounts a pair of 2 CM *Flak Zwilling*, which was an unusual arrangement for an *S-boot*. The Danes widened the depression rail striker bars by a safe margin. Horizontal surfaces are a light gray, with black bow numbers. T-52 was renamed GRIBBEN (P552) in 1951 and stricken ten years later. (L. Alring/Royal Danish Navy)

HEJRIN (P566) has been thoroughly modernized with NATO standard 53.3 CM (21 inch) torpedo tubes, electronics, and a coat of khaki green paint. Nevertheless, this fine portrait evokes its proud heritage as the *Kriegsmarine*'s S-117. The pennant number on the hull side below the *Kalotte* was standard for North Atlantic Treaty Organization (NATO) vessels. She is armed with one 2 CM cannon in the bow and a 4 CM cannon on the aft deck. HEJRIN and VIBEN (P568, formerly S-68 and T-62) were decommissioned in 1965 – the last of the ex-*Kriegsmarine S-boote* to serve in the Royal Danish Navy. (L. Alring/Royal Danish Navy)

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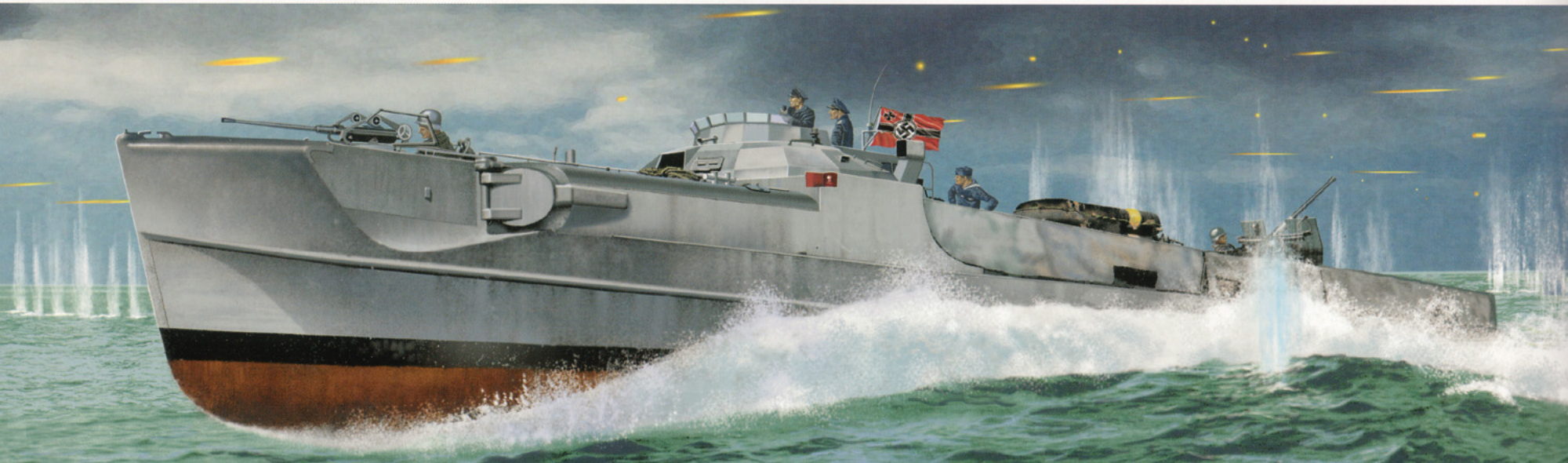
(Above) An S-7 Class *Schnellboot* cruises in the North Sea off Norway in the spring of 1940. This boat's vertical surfaces were painted dark gray for operations during this period.

(Below) This S-38b Class vessel dodges enemy fire while raiding Allied shipping in the English Channel in 1942. The boat is armed with a 20MM cannon at the bow and a 40MM gun at the stern.